

What is the definition of the Durbin-Watson test and can you provide an example of its application?

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The Durbin-Watson test is a statistical method used to assess the presence of autocorrelation in a set of data. It measures the degree to which the residuals (or errors) of a regression model are correlated with each other. The test produces a statistic, known as the Durbin-Watson statistic, that ranges from 0 to 4. A value of 2 indicates no autocorrelation, while values closer to 0 or 4 indicate positive or negative autocorrelation, respectively. This test is commonly used in econometrics and time series analysis to evaluate the validity of a regression model. For example, a researcher may use the Durbin-Watson test to determine if there is a relationship between advertising expenditure and sales for a particular product.

The Durbin-Watson Test: Definition & Example

One of the is that there is no correlation between consecutive . In other words, it's assumed that the residuals are independent.

When this assumption is violated, the standard errors of the coefficients in a regression model are likely to be underestimated which means predictor variables are more likely to be deemed when they're actually not.

One way to determine if this assumption is met is to perform a Durbin-Watson test, which is used to detect the presence of autocorrelation in the residuals of a regression.

Steps to Perform a Durbin-Watson Test

The Durbin-Watson test uses the following hypotheses:

H0 (null hypothesis): There is no correlation among the residuals.

HA (alternative hypothesis): The residuals are autocorrelated.

The test statistic for the Durbin-Watson test, typically denoted d , is calculated as follows:

$$d = \frac{\sum_{t=2}^T (e_t - e_{t-1})^2}{\sum_{t=1}^T e_t^2}$$

where:

T: The total number of e_t : The t th residual from the regression model

The test statistic always ranges from 0 to 4 where:

$d = 2$ indicates no autocorrelation
 $d < 2$ indicates positive serial correlation
 $d > 2$ indicates negative serial correlation

In general, if d is less than 1.5 or greater than 2.5 then there is potentially a serious autocorrelation problem. Otherwise, if d is between 1.5 and 2.5 then

autocorrelation is likely not a cause for concern.

To determine if a Durbin-Watson test statistic is significantly significant at a certain alpha level, you can refer to of critical values.

If the absolute value of the Durbin-Watson test statistic is greater than the value found in the table, then you can reject the null hypothesis of the test and conclude that autocorrelation is present.

What to Do if Autocorrelation is Detected

For positive serial correlation, consider adding lags of the dependent and/or independent variable to the model. For negative serial correlation, check to make sure that none of your variables are *overdifferenced*. For seasonal correlation, consider adding seasonal dummy variables to the model.

These strategies are typically sufficient to remove the problem of autocorrelation.

Examples of Performing a Durbin-Watson Test

For step-by-step examples of Durbin-Watson tests, refer to these tutorials that explain how to perform the test

using different statistical software:

How to Perform a Durbin-Watson Test in Excel

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