

## ACF VS PACF

Autocorrelation function (ACF) and Partial Autocorrelation Function (PACF, also called Partial ACF) are important functions in analyzing a time series. They generally produce plots that are very important in finding the values  $p$ ,  $q$  and  $r$  for Autoregressive (AR) and Moving Average (MA) models.

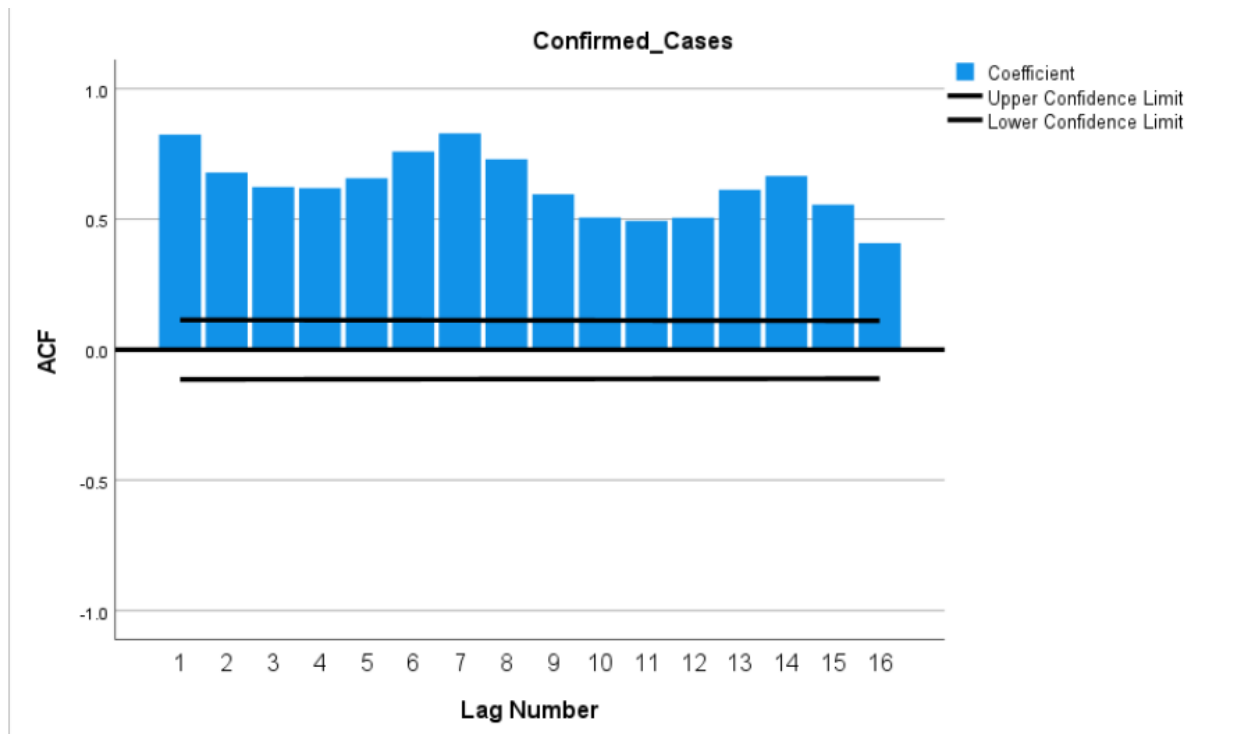
An ACF measures and plots the average correlation between data points in time series and previous values of the series measured for different lag lengths.

A PACF is similar to an ACF except that each partial correlation controls for any correlation between observations of a shorter lag length.

The value for an ACF and a PACF at the first lag are the same because both measure the correlation between data points at time  $t$  with data points at time  $t-1$ . However, at the second lag, the ACF measures the correlation between data points at time  $t$  with data points at time  $t-2$ , while the PACF measures the same correlation but after controlling for the correlation between data points at time  $t$  with those at time  $t-1$ .

### **Example:**

In IBM SPSS Statistics, the general procedure is Analyze ---> Forecasting ---> Autocorrelations.



As shown in the figure above, the estimated correlations in the ACF do not decay to zero. This

suggests that the time series is non-stationary and should be differenced before further interpretation.

We re-run the same procedure and add differencing. The following is the outputs for ACF and PACF.

