

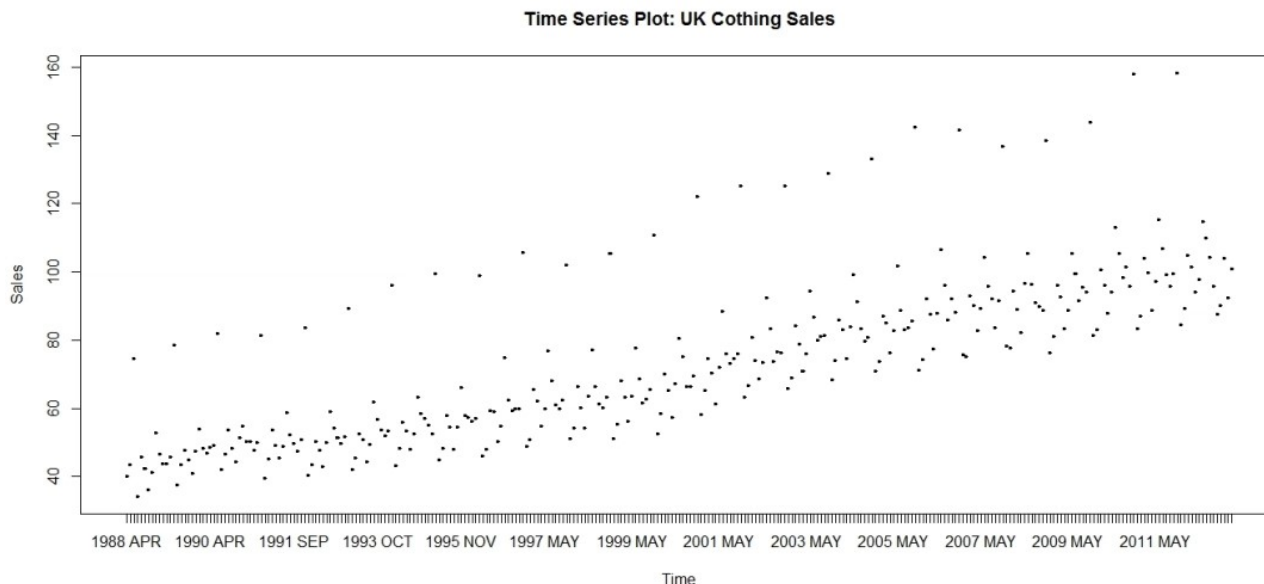
How to Use Autocorrelation Function (ACF) to Determine Seasonality

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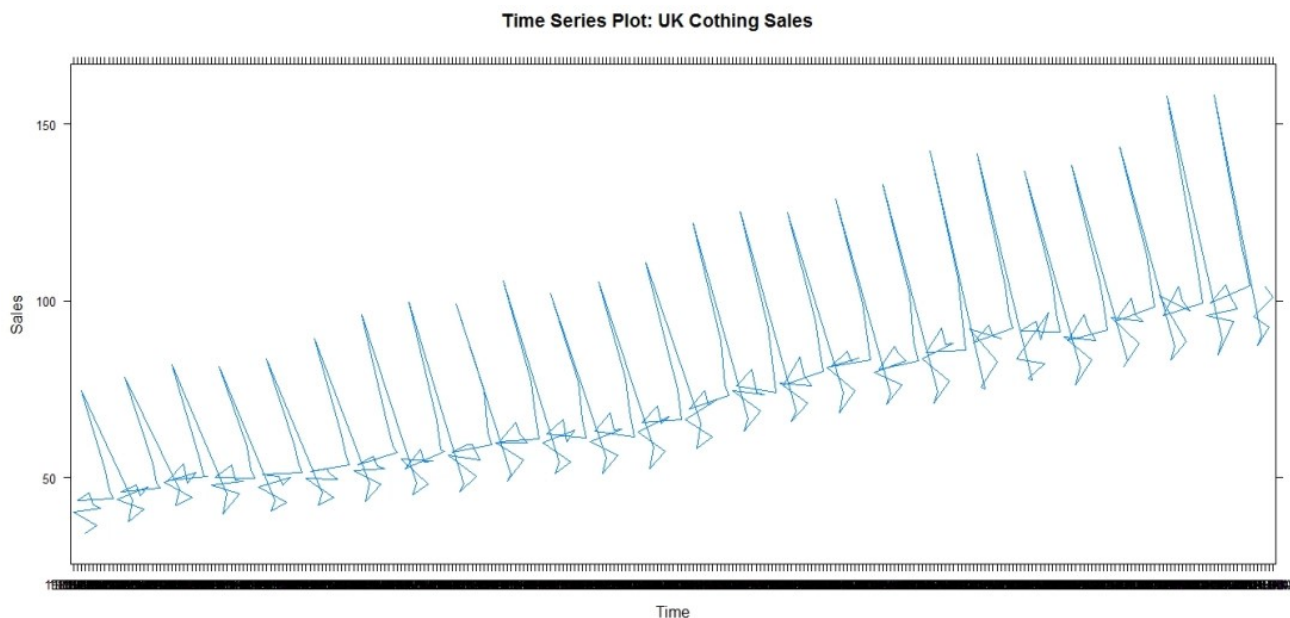
In my [previous post](#), I wrote about using the autocorrelation function (ACF) to determine if a timeseries is stationary. Now, let us use the ACF to determine **seasonality**. This is a relatively straightforward procedure.

Firstly, seasonality in a timeseries refers to predictable and recurring trends and patterns over a period of time, normally a year. An example of a seasonal timeseries is retail data, which sees spikes in sales during holiday seasons like Christmas. Another seasonal timeseries is box office data, which sees a spike in sales of movie tickets over the summer season. Yet another example is sales of Hallmark cards, which spike in February for Valentine's Day.

The below graphs show sales of clothing in the UK, and how these sales follow seasonal trends, spiking in the holiday season:



Clothing Sales in the UK

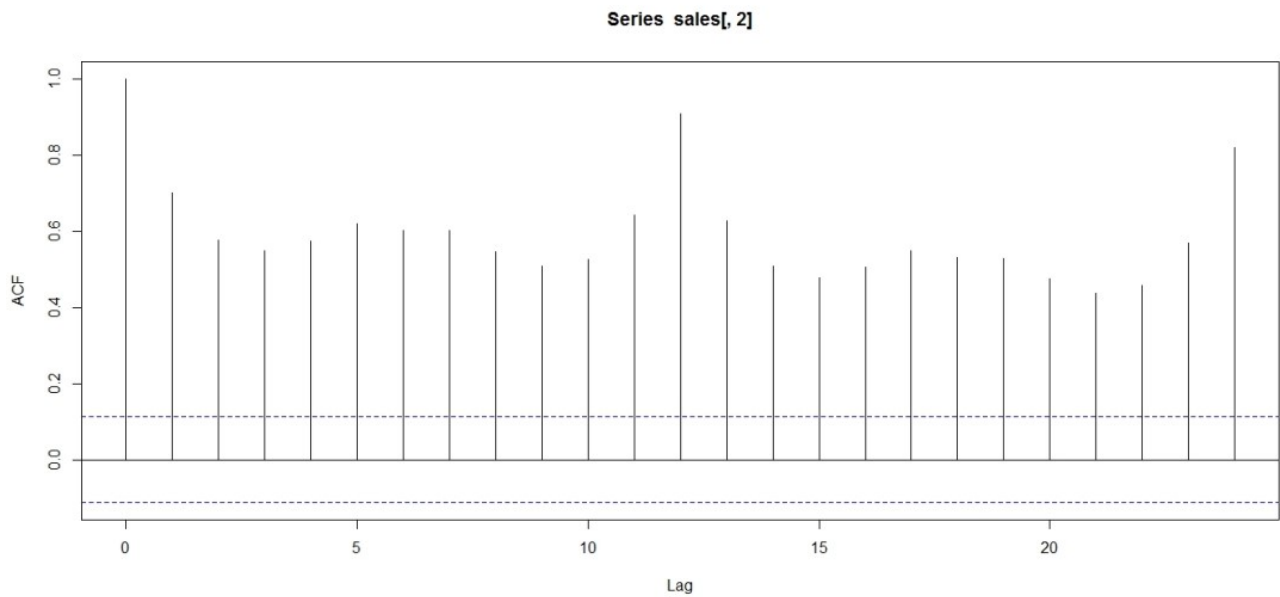


Clothing Sales in the UK: line graph

Note the spikes in sales, which obediently occur every December, in time for Christmas. This is evident in the trail of December plot points (Graph 1), which hover significantly above the sales data for other months, and also in the actual spikes of the line graph (Graph 2).

The above is a simple example of a seasonal timeseries. However, timeseries are not always simply seasonal. For example, a SARMA process comprises of seasonal, autoregressive, and moving average components, hence the acronym. This will not look as obviously seasonal, as the AR and MA processes may overlap with the seasonal process. Thus, a simple timeseries plot, as shown above, will not allow us to appreciate and identify the seasonal element in the series.

Thus, it may be advisable to use an autocorrelation function to determine seasonality. In the case of seasonality, we will observe an ACF as below:



ACF of UK clothing sales data

Note that the ACF shows an oscillation, indicative of a seasonal series. Note the peaks occur at lags of 12 months, because April 2011 correlates with April 2012, and 24 months, because April 2011 correlates with April 2013, and so on.

The above analyses were conducted on R. Credits to data.gov.uk and the Office of National Statistics, UK for the data.

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