Time Series (pt.1)

What is it?

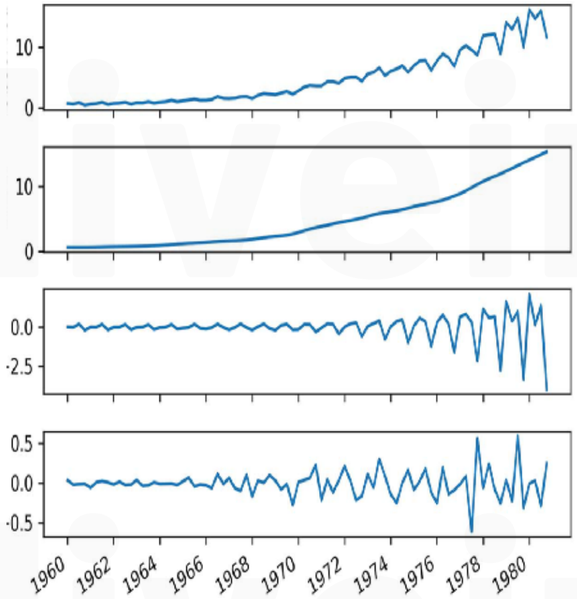
A set of observations at equal time intervals (t) day, hour, month, week, etc

These can be decomposed in three components:

- Trend - the **direction** towards which the graph develops over a long period.
- Seasonality - almost **identical patterns** that occur during the same periods.
- Residuals/Errors - **sporadic shifts** caused by chance events.

And are defined by: $y_t = T_t + S_t + E_t$ When variance is constant

$y_t = T_t S_t E_t$ When variance is high and increasing over time



Key concepts

Stationarity

- Constant average;
- Finite and constant variance;
- Constant covariance.

Classical models cannot only be used on non-stationary series.

Lag and difference operators

$$L^h y_t = y_{t-h}$$

$$\Delta y_t = y_t - y_{t-1} = (1 - L) y_t$$

Estimation of the orders of the terms

(p,k,q) Trend terms

(P,K,Q) & (s) Seasonality terms

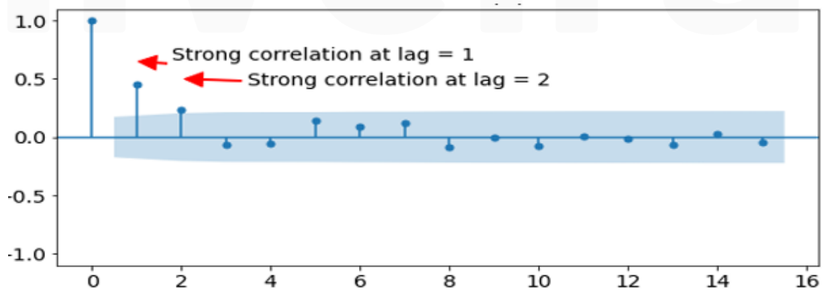
How is it done?
Via the ACF and PACF plots

- Pre-condition: Stationary;
- Finite and constant variance;
- Constant covariance.

Autocorrelation (ACF)

Correlation between current and past values.

Everything



Blue areas = 95% confidence intervals

Partial Autocorrelation (PACF)

Correlation of the residuals with the value of the next lag (which remain after removing the effects that are already explained by previous lag(s).

Residuals (E)