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Stationarity, white noise & (P)ACF

- A TS is weakly stationary if its mean is constant & autocovariances do not vary over time
- A TS is strictly stationary if its properties are unaffected by a change in the time origin \therefore invariant wrt time.
 $\hookrightarrow \text{Cov}(y_t, y_{t-k}) = E[(y_t - \mu_t)(y_{t-k} - \mu_{t-k})]$

white noise is the simplest stationary process

$$\hookrightarrow E(\varepsilon_t) = 0 \rightarrow \text{Var}(\varepsilon_t) = \sigma^2 \rightarrow \rho = 0 (k > 0) \rightarrow \varepsilon_t \sim \text{iid}(0, \sigma^2)$$

ACF: Plots the average correlation between TS and previous values for different lag length

PACF: Same as above but measures r/ship to specific lag lengths

$$\text{R\&T for lag length: } S = n(10, \frac{t}{S})$$

To test if autocorrelation is present we have two tests

Box-Pierce

$$Q_{BP} = T \sum_{k=1}^S r_k^2$$

Ljung-Box

$$Q_{LB} = T(T+2) \sum_{k=1}^S \frac{r_k^2}{T-k}$$

H_0 : no autocorrelation of order 1-6
 H_a : at least one autocorrelation order $\neq 0$

