

Time series1

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Time series basics

- a sequence of random variables Y_t , autocovariances: $\gamma_{t,k} = cov(Y_t, Y_{t+k})$; autocorrelations: $\rho_{t,k} = corr(Y_t, Y_{t+k})$.
- **Covariance Stationarity**: $\mu_t = E(Y_t) = \mu$ and $\gamma_{t,k} = \gamma_k, \forall t, k$.
- AP(p) process: $\phi(L)Y_t = \varepsilon_t$, where $\phi(L) = (1 - \phi_1 L - \dots - \phi_p L^p)$ and ε_t is white noise.
- MA(q) process: $Y_t = \theta(L)\varepsilon_t$ where $\theta(L) = (1 - \theta_1 L - \dots - \theta_q L^q)$ and ε_t is white noise.
- ARMA(p, q): $\phi(L)Y_t = \theta(L)\varepsilon_t$
- **Wold decomposition** theorem: If there is a covariance stationary series, then I can break Y_t into ε pieces, which is uncorrelated with each other.

$$Y_t = \varepsilon_t + c_1 \varepsilon_{t-1} + \dots$$

where ε_t is white noise with variance $\sigma_\varepsilon^2, \sum_{i=1}^{\infty} c_i^2 < \infty$ and $\varepsilon_t = Y_t - Proj(Y_t | \text{lags of } Y_t)$.