Econometric Analysis ECMT2160 Time Series Definitions

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Strictly exogenous: $E(\epsilon_t|\boldsymbol{x}_t) = 0 \forall t$

Weakly exogenous: $E(\epsilon_t|\boldsymbol{x}_t, \boldsymbol{x}_{t-1}, ...) = 0$ for the period t and periods before it.

Contemporaneous exogeneity: Special case of weakly exogenous where $E(\epsilon_t|\boldsymbol{x}) = 0$ for just the current time period.

White Noise: $\epsilon \sim iid(0, \sigma^2)$

Serial Correlation/Autocorrelation: $Cov(\epsilon_t, \epsilon_s) \neq 0 \quad for \quad t \neq s$

Unit roots: We can think of them as a **stochastic trend** in time series. If we had a time series of:

$$y_t = c + \alpha_1 y_{t-1} + \epsilon_{t-1}$$

the coefficient α_1 is a root. We expect this process to always converge back to the value of c when $\alpha < 1$. If we set c = 0 and $\alpha = 0.5$, if y_{t-1} was 100, then today it's 50, tomororow 25, and so on until it gets to 0. Here, we can see that this series will converge back to c. However, if we had a root that is a **unit**, or in other words, when $\alpha = 1$, we see that the series will never converge back to c. From this, we can see that the time series will never recover back to its expected value and therefore the process is very susceptible to shocks and hard to predict.

Weakly dependent/Highly Persistent: $Corr(x_t, x_{t+h}) \to 0 for h \to \infty$.

Spruious regression/relationship/correlation: A mathematical relationship in which two or more events or variables are not causally related to each other, yet it may be wrongly inferred that they are, due to either coincidence or the presence of a certain third, unseen factor. Good example of this is between independent **non-stationary** variables with **unit roots**.