Summary/Review

**Stationarity**

Stationarity impacts our ability to model and forecast

* A **stationary** series has the same mean and variance over time
* **Non-stationary** series are much harder to model

Common approach:

* Identify sources of non-stationarity
* Transform series to make it stationary
* Build models with stationary series

The **Augmented Dickey-Fuller (ADF) test** specifically tests for stationarity.

* It is a hypothesis test: the test returns a p-value, and we generally say the series is non-stationary if the p-value is less than 0.05.
* It is a less appropriate test to use with small datasets, or data with heteroscedasticity (different variance across observations) present.
* It is best to pair ADF with other techniques such as: run-sequence plots, summary statistics, or histograms.

Common Transformations for Time Series include:

Transformations allow us to generate stationary inputs required by most models.

There are several ways to transform nonstationary time series data:

* Remove trend (constant mean)
* Remove heteroscedasticity with log (constant variance)
* Remove autocorrelation with differencing (exploit constant structure)
* Remove seasonality (no periodic component)
* Multiple transformations are often required.

**Time Series Smoothing**

**Smoothing** is a process that often improves our ability to forecast series by reducing the impact of noise.

There are many ways to smooth data. Some examples:

* Simple average smoothing
* Equally weighted moving average
* Exponentially weighted moving average

This are some suggestions for selecting a Smoothing Technique. If your data:

–       **lack a trend**

* Then use Single Exponential Smoothing

–       **have trend but no seasonality**

* Then use Double Exponential Smoothing

–       **have trend and seasonality**

* Then use Triple Exponential Smoothing