TIME SERIES ANALYSIS LECTURE 1

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Steps to Analyze Time Series Data

General Approach That We Will Use to Learn Time Series Modeling

1. Learn about the mathematical formulation of a model or an important concept (such as autocorrelation function).
2. Derive some of the most important properties of the model.
3. Simulate (using R or Python) a number of realizations from the model.
4. Examine the empirical properties exhibited in the simulated realizations.
5. Apply the model or concept to a real-world datasets.

General Steps to Analyze a Time Series

1. Based on the interaction of theory, subject matter expertise, or even practical experience, consider a useful class of models.

2. Collect and cleanse the data.

3. Conduct with exploratory time series data analysis (ETSDA) by plotting the series using various graphical techniques and examine both the main patterns and atypical observations in the graphs, after collecting and "cleaning" the data :

   - Trend
   - The fluctuation around a trend
   - Sharp change in behavior (i.e., structural change or jumps)
   - Outliers

4. Examine and (statistically) test whether the series is stationary.

General Steps to Analyze a Time Series (2)

5. If the series is not stationary, transform the series to a stationary series (if a stationary time series model will be used), because the time series models covered in this course apply only to stationary or integrated times series. Common transformation techniques include trend removal (i.e., detrending), seasonality removal, logarithmic, and difference transformation.

6. Model the transformed series using a stationary or integrated time series model.

7. Examine the validity of the model's underlying assumptions.
   - This is an important step, because if the model's underlying assumptions are not satisfied, one should not proceed to conducting statistical inference and forecasting.

8. Among the valid models, choose the one that perform "best" according to some prespecified metrics or business needs (if the model is for business use).

9. Once a (statistically) valid model is chosen, conduct forecasting (or other statistical inference).