Statistics 434: Bullet Points for Day 5
Autocorrelation Tests — Especially the Ljung-Box Test

When is it feasible to treat a series of returns as if they are independent? In other words, when do returns behave like noise? This is one of the most basic questions that one can ask about a series of financial returns.

The assumption of independence of returns is widely used in financial theory and practice. For example, it is crucial to the assumptions that support the Black-Scholes formula for option price. We are well served by developing a refined understanding of when and how this assumption is reasonable. Today we will consider the most well known test for dependence in a stationary time series. We will then apply this test to monthly MSFT and SP500 return series.

- Autocorrelation Tests
  1. The general idea — and how it "goes beyond" testing for significance of a given autocorrelation.
  2. The historical Box-Pierce statistic and the contemporary Ljung-Box statistic
  3. Attention to the dependence on the number of lags.
- The MSFT example (via singleIndex.dat)
  1. Finmetrics tools (module, class, slotNames, "@" selection, positions)
  2. Calculation of returns via getReturns()
  3. Use of autocorTest()
  4. The p-value plot by number of lags (important example)
- Discussion of Homework 2 assignment
- The Lag Operator and the AR(1)
- Geometric Series and the Simplest Wold Representation
- Seeing what you can see from the Wold Representation
  1. It makes stationarity *completely intuitive*
  2. It really explains why we need $|\rho| < 1$
  3. It gives another derivation of the remarkable τ^2

The Subtle and Perplexing *Assumption* of Stationarity

We've discussed the formal definition of stationarity, and by now I am sure that you can write it down faultlessly. We will continue to build intuition about stationarity in the context of models — and in the context of empirical data.

We will repeat to ourselves on innumerable occasions a phrase like "assuming stationarity." Still, you are encouraged not to take this assumption lightly. Philosophically, it does the heavy lifting. It makes the world go round — or not.