The first question that one must ask of a stationary time series is simply “Do I have any reason to believe that there is any dependence among these values, or do they behave like independent random variables?”

Historically, the autocorrelation function (or ACF) has provided the first line of approach. A second level tool is the Ljung-Box statistic, which provides us with a more global view than values of the ACF. In many applications, these tools have serve us well, but, to be sure, they have limitations. Specifically they only help us to see only certain kinds of dependence. Still, they are reasonably robust to the kinds of alternatives that appear in practice, and, as a result, these tools are perhaps even more useful than pure theory might suggest.

- Begin with questions and comments on HW1
- Introduce the theoretical ACF
- The theoretical ACF for AR(1) — Issue of exponential decay
- The sample ACF and feasibility diagnostics for AR(1)
- Introducing the Finmetrics module
  1. acf — and help(acf). Note: We use the acf, function — not ACF.
  2. Discussion of the arima.sim function in Finmetrics
  3. Accessing the components using the “$” list extractor
  4. Plotting commands including multiple plots on a page
- Preparation for the Ljung-Box Statistic — the tools and concepts
  1. Review of the Chi-square distribution (especially the definition!)
  2. Comments on the role of the Chi-square distribution in the t-statistic
  3. Another pass at the qqplot() — this time for the Chi squared distribution
  4. Introduction to “Tests to determine dependence” — and the Ljung-Box Statistic

Perspective on our Challenge

Today we have set up the machinery to start to understand if a return series is just “pure noise” or if there is some structure that we might be able to exploit. This conversation requires that one understand the words “distribution,” ”joint distribution,” and ”independence.” A intuitive understanding of these words is very important, yet such an understanding has limitations. You should confirm for yourself that you also know the actual mathematical definition of these terms.