Stat 434: Financial statistics

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Administrivia

- This is my first time teaching this class–so I might change things up as I go along.

- Current plan:
  - Several homework
  - Final project
  - Final exam (If we end up doing extensive enough data analysis in R and large enough homeworks, I’ll probably kill the final. Unless you alls really want one.)

- Office hours: Thursday at 1pm (in R2D2 472). Email is best though! I live in NYC, so when I’m in town I frenetic.

- Assumed background
  - STAT 430 (i.e. a strong probability background)
  - STAT 431 / STAT 102 (I.e. a good statistics background)
  - FIN 101: You will enjoy the class better if you have had a finance class already.
  - some background in math. I’ll use sums and teach products

- Homework due next wednesday. Dice simulation. You should work with someone else in class. Do you probably want to do it tonight or tomorrow night if you are going away for labor day.

- Questionnaire: who are you?
Difference with Mike Steele’s version of this class

- It used to be Mike taught 434 and I taught 471
  - In 471, I taught that you can’t make money in the market
  - In 434, Mike taught that you could.
  - It was fun for the students in both classes.

- But, I’ll be teaching both. Who is also in 471?
  - So it will be efficient market everywhere!
  - But I’ve removed almost all of the finance from 471 now.
  - So there is only one homework in common and I think no lectures in common.

- So if you are here to beat the market, I won’t be able to help you all that much.

Course topics

- We’ll start with portfolio theory a bit. This should be a review.
  - Means and variances
  - Utility theory
  - Taylors theorem
  - CAPM

- Then we’ll turn to time series
  - how to fit financial data?
  - what parts are predictable? What is noise?
  - Lots of data analysis
  - ARCH / eGARCH / stochastic volatility

- The lack of cheese! Bonferroni
  - We’ll discuss 3 common errors in the search for excess returns
– We’ll show how to use these errors to con other people, but not yourself.

• Amazing Hedging theory
  – There is a beautiful connection from hedging theory to machine learning.
  – This is pure theory. So I haven’t decided if I should cover it or not.

• Along the way we’ll visit with;
  – high frequency data
  – linguistic data (i.e. tweets)
  – market makers
  – information markets (i.e. who will be the next president?)

**Notation**

• Basic returns
  \[ R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \]

  So,
  \[ P_t/P_0 = \prod_{j=1}^{t} (1 + R_j) \]

  called product

• Relationship between sums / products
  – converting between them
  – For more details, read chapter 1

• Central limit theorem: for sums of RV

• We can get a related result for products: generates log normal.

• Normals / log normals distributions

• Stable laws: \( A = k(B + C) \) where \( B \perp C \), and \( A, B, C \) all have the “same” distribution.

• Mixtures of normals