ECON 504: Advanced Economic Statistics

August 23, 2011
• Elementary Economic Statistics, a Review
• Statistics to include two parts: descriptive and analytic
• Tabular and graphic presentation of data comprises one-third of the book. It is well done
• Statistical inference
  – discussion of frequency distributions
  – A "cook-book" consideration of estimation and testing hypotheses about one or two population means follows.
• Tuttle's chapter on index numbers is probably the best in the book.
• Most authors give a confusing presentation of the analytic areas of estimation, hypothesis testing, and correlation or regression theory.
• Mechanical consideration of time series is given exaggerated significance. Fleeting remarks alluding to more complex, analytic methods are not sufficient.
• The utility of tables on logarithms, squares, roots, reciprocals, and random digits is not clear.

• Brace & Brace – TOC
  – 2. Organizing Data
  – 3. Averages and Variation
  – 4. Correlation and Regression
  – 5. Elementary Probability Theory
  – 6. The Binomial Probability Distribution and Related Topics
  – 7. Normal Curves and Sampling Distributions
  – 8.1 Estimating \( \mu \) When \( \sigma \) is Known
  – 8.2 Estimating \( \mu \) When \( \sigma \) is Unknown
  – 8.3 Estimating \( p \) in the Binomial Distribution
  – 9.2 Testing the Mean of \( \mu \)
  – 9.3 Testing a Proportion \( p \)
  – 10. Inferences About Differences
  – 11.1 Chi-Square: Tests of Independence
  – 11.2 Chi-Square: Goodness of Fit
  – 11.3 Testing a Single Variance or Standard Deviation
  – Part II: Inferences Relating to Linear Regression
  – 11.4 Inferences for Correlation and Regression

• Supposed to know - Basic notation and definitions
Econometric Analysis, 6th Edition (Greene)

- Chapter 2. The Classical Multiple Linear Regression Model
- Chapter 3. Least Squares
- Chapter 5. Inference and Prediction
- Chapter 6. Functional Form and Structural Change
- Chapter 8. The Generalized Regression Model
- Chapter 9. Models for Panel Data
- Chapter 11. Nonlinear Regressions and Nonlinear Least Squares
- Chapter 15. Minimum Distance Estimation and The Generalized Method of Moments
- Chapter 16. Maximum Likelihood Estimation
- Chapter 17. Simulation Based Estimation and Inference
- Chapter 18. Bayesian Estimation and Inference
- Chapter 19. Serial Correlation
- Chapter 21. Time-Series Models
- Chapter 22. Non-stationary Data
- Chapter 24. Truncation, Censoring and Sample Selection
- Chapter 25. Models for Counts and Duration
- Appendix D. Large Sample Distribution Theory

2. Sharp bounds on the expected payoffs and prices of European call options

Let $\mathcal{F}_0 \subseteq \mathcal{F}_1 \subseteq \ldots \subseteq \mathcal{F}_t$ be a sequence of $\sigma$-algebras on a probability space $(\Omega, \mathcal{F}, P_t)$. Throughout the paper, we deal with a complete and arbitrage-free securities market consisting of two assets. One asset is the risky asset with price $S_t \geq 0$ for $t \geq 0$. The sequence $(S_t)$ is adapted to the sequence of information sets $(\mathcal{F}_t)$ and the nonnegativity constraint reflects the limited-liability condition inherent in a contingent claim. The second asset is a money-market account with a risk-free rate of return $r$. In what follows, $E_t[\cdot] = E_t[\cdot | \mathcal{F}_t]$ denotes the day-$t$ conditional expectation and $P_t = P_t(\cdot | \mathcal{F}_t)$ denotes the day-$t$ conditional probability.

Let us begin by recalling the results on an option's expected payoff and current price obtained by Lo (1987) and Grundy (1991). Consider a European call option on the risky asset with strike price $K$ and expiring at time $T$. The day-$t$ expected payoff of the option is $E_t \max(S_T - K, 0)$ and its day-$t$ risk-neutral price is $e^{-r(T-t)} E_t^* \max(S_T - K, 0)$, where $E_t^*$ denotes the expectation with respect to the unique equivalent probability measure. Lo (1987) showed that the day-$t$ expectation $E_t \max(S_T - K, 0)$ satisfies the following sharp inequalities:

$$E_t \max(S_T - K, 0) \leq \begin{cases} \frac{\mu_t - K}{\sigma_t^2 + \mu_t^2} & \text{if } K \leq \frac{\sigma_t^2 + \mu_t^2}{2\mu_t}, \\ \frac{1}{2} [\mu_t - K + \sqrt{(K - \mu_t)^2 + \sigma_t^2}] & \text{otherwise}, \end{cases}$$

(1)

where

$$\mu_t = E_t S_T \quad \text{and} \quad \sigma_t^2 = E_t S_T^2 - \mu_t^2.$$
GDP, Nominal Dollars (T's)

$Y(t) \sim GBM(\mu, \sigma)$

$\mu = 0.067$

$\sigma = 0.022$
QQ-Plot, GDP Returns 1947-2008

GDP Quarterly Returns
Y = C + I + G + X

- What is the DGP?
- How to Model?
• Introduction to probability theory – description and analysis of probability models
• Mathematic statistics and concepts. Learning about the features of probability model based on data.
• What to Expect
  – More of this! Worse than this!
  – Remember the violin story