

Syllabus for FBE 599, Section #15482

Time Series Models of Asset Prices

Fall 2008

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Summary

This is a half-credit course designed to introduce you to a variety of models used mostly to describe the time series behavior of asset prices and to show you a number of methods that can be used to estimate these models. The emphasis of the course will be on implementation via high-level programming languages such as Matlab or R.

Class meetings

The class will meet in HOH 506 for 10 Thursdays from 2:00 to 4:00 starting on August 28 and ending on November 13. There will be no class on October 2 or October 30. In addition, I will hold optional weekly hour-long “lab sessions” after class for those who need help with programming.

Grading

Grades will be based on class participation (25%) and six programming projects (75%, not equally weighted). There will be no midterm or final.

Programming projects

All projects are due on Fridays at 5:00pm. In the event that you believe a project to be a waste of your time because it is something you already know how to do, feel free to propose a more challenging project as a substitute.

Each submission of a project should include a text or Word file containing all program output and all files required to produce that output. All code should be adequately documented. Projects should be

handed in electronically using the “Digital Drop Box” feature in Blackboard. Please upload a single ZIP file that includes all parts of your submission.

All of my solutions to the projects will be written in Matlab. I would encourage you to submit your projects in Matlab as well. If you choose to use another language, like R, then I may be less able to provide useful feedback.

Required texts

We will not use any one textbook very much, but I will assume you have or have access to the following:

Campbell, Lo, and MacKinlay (“CLM”), *The Econometrics of Financial Markets*

Cochrane, *Asset Pricing*

Cvitanic and Zapatero, *Introduction to the Economics and Mathematics of Financial Markets*

Greene, *Econometric Analysis*, 6th edition

Hamilton, *Time Series Analysis*

All other readings will be provided in advance on the course Blackboard page.

Course Outline

August 28, 2008

Readings: Greene – chapter 16 (MLE), Engle article

Topics: statistical properties of stock market returns, modeling volatility with mixture and GARCH models, MLE estimation, QML standard errors for GARCH

September 4, 2008

Readings: Greene – chapter 15 (GMM), Chan, Karolyi, Longstaff, and Sanders article

Topics: statistical properties of interest rates, GMM estimation, one-factor models of interest rates

September 5, 2008

Project 1 due: estimate the GARCH(1,1) model

September 11, 2008

Readings: Cvitanic and Zapatero chapter 11.2, Melino and Turnbull article

Topics: statistical properties of market volatility, simulated method of moments

September 12, 2008

Project 2 due: estimate the CIR model using the CKLS approach

September 18, 2008

Readings: Brandt and Santa Clara article, Greene chapter 15, Cochrane chapter 19

Topics: approximating diffusion processes, simulated MLE

September 25, 2008

Readings: Cvitanic and Zapatero chapter 8.2, Brown and Dybvig article,

Topics: bond prices and expectations in affine models

September 26, 2008

Project 3 due: estimate the Melino and Turnbull model using SMM

October 9, 2008

Readings: Balduzzi, Das, and Foresi article, Hamilton chapter 13

Topics: estimating affine models, the Kalman filter

October 16, 2008

Readings: Kim and Nelson chapter 7, Hasbrouck article and technical appendix

Topics: Bayesian analysis, the Gibbs sampler, Roll's model of bid-ask spreads

October 17, 2008

Project 4 due: estimate the CIR model using the "inversion method" or the Kalman filter

October 23, 2008

Readings: Kim and Nelson article, Greene chapter 18

Topics: more Bayesian analysis, regime switching models

October 31, 2008

Project 5 due: estimate the discretized Vasicek model using the Gibbs sampler

November 6, 2008

Readings: Heston and Nandi article

Topics: option pricing models

November 13, 2008

Readings: Greene chapter 14.4, CLM chapter 12.3, Jackwerth article

Topics: nonparametric density estimation and kernel regression, implied pricing kernels

November 15, 2008

Project 6 due: estimate a regime-switching model of GDP growth via Bayes or MLE

References

Balduzzi, Pierluigi, Sanjiv Ranjan Das, and Silverio Foresi, 1998. "The Central Tendency: A Second Factor in Bond Yields," *Review of Economics and Statistics* 80, 62-72.

Brandt, Michael, and Pedro Santa-Clara, 2002, "Simulated Likelihood Estimation of Diffusions with an Application to Exchange Rates Dynamics in Incomplete Markets," *Journal of Financial Economics* 63, 161-210.

Brown, Stephen, and Philip Dybvig, 1986, "The Empirical Implications of the Cox, Ingersoll, Ross Theory of the Term Structure of Interest Rates," *Journal of Finance* 41, 617-630.

Chan, K.C., Andrew Karolyi, Francis Longstaff, and Anthony Sanders, 1992, "An Empirical Comparison of Alternative Models of Short-Term Interest Rates," *Journal of Finance* 47, 1209-1227

Engle, Robert, 2001, "GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics," *Journal of Economic Perspectives* 15, 157-168.

Hasbrouck, Joel, 2002, "Markov Chain Monte Carlo Methods for Bayesian Estimation of Microstructure Models," working paper, NYU (this is an unpublished appendix to the Hasbrouck JFQA paper)

Hasbrouck, Joel, 2004, "Liquidity in the Futures Pits: Inferring Market Dynamics from Incomplete Data," *Journal of Financial and Quantitative Analysis* 39.

Heston, Steven, and Saikat Nandi, 2000, "A Closed-Form GARCH Option Pricing Model," *Review of Financial Studies* 13, 585-625.

Jackwerth, Jens, 2000, "Recovering Risk Aversion from Option Prices and Realized Returns," *Review of Financial Studies* 13, 433-451.

Kim, Chang-Jin, and Charles Nelson, 1999, "Has the U.S. Economy Become More Stable? A Bayesian Approach Based on a Markov-Switching Model of the Business Cycle," *Review of Economics and Statistics* 81, 608-616.

Kim, Chang-Jin, and Charles Nelson, 1999, *State Space Models with Regime Switching*.

Melino, Angelo, and Stuart Turnbull, 1990, "Pricing Foreign Currency Options with Stochastic Volatility," *Journal of Econometrics* 45, 239-265.