

Economics 285F
Advanced Econometrics (Time Series)
Spring Quarter 2008

Instructor: Professor Tae-Hwy Lee

Lectures: WF 2:40 - 4:00 p.m., SPR 3123

Office hours: WF 10:30 - 11:30 a.m., open door when available, or by appointment.

Course Description: This is an *advanced econometric theory* course dealing with nonstationary time series, nonlinear time series, and volatility modelling, with particular emphasis on the recent development in forecasting research and in financial econometrics. Bootstrap theory may be covered if time permits.

Course Requirements:

The course grade will be based on three items: (1) problem sets, (2) problems raised during the lectures, and (3) a paper and a 30-45 minute lecture (presentation) on a particular topic.

(1) and (2) will be the same for everyone. (3) will be chosen individually from a set of topics (to be provided). Reports on (2) and (3) should be typed and submitted electronically via email.

Examples of (2) may be to prove a main theorem of West (1996), to prove the asymptotic equivalence of the cross-validation and the information criterion, to derive the asymptotic distribution of Johansen (1991) test statistics, to show the consistency of factor estimator in Stock and Watson (2002), to prove the consistency of bootstrap, and etc. A chosen person in rotation (with one week notice) will present each solution (for 10-20 minutes).

Examples of (3) may be either a survey of the recent literature or an indepth study of one or two seminal papers, on boosting, bagging, quantile regression, realized volatility, multivariate GARCH, MIDAS regression, various bootstrap for dependent time series, cross-validation, pretest estimators, various regularized regressions, forecast combination, model averaging, sieve, nonlinear modelling, comparing predictive ability, factor models, etc. The topic for (3) should be related to the material treated in the course (or suitable extensions of it). I will prepare a set of relevant topics from which you choose one. A first draft for the paper will be due on May 27. The final version of the paper is due on June 3, and it will be distributed to the class before the presentation. All versions should be typed. All of your lectures (presentations) will be scheduled during the last week of the instruction (June 4, 6) and the final exam week (June 9?, 11, 13).

In order to *pass* the course, (i) all of (1), (2), and (3) must be completed with a grade of at least 50%, (ii) you read all the articles and book chapters covered in the lectures, and (iii) you attend in all lectures and presentations.

Course Outline:

1. Regression with Time Series

- (a) asymptotic properties of MLE
 - (b) assumptions
 - (c) asymptotic properties, Cramer-Wold
 - (d) LS, IV, GMM
 - (e) HAC, efficiency
 - (f) model selection and cross-validation
 - (g) specification testing
 - (h) ARIMA models
 - (i) bootstrap and asymptotic expansion
2. Introduction to Forecasting
- (a) principles of forecasting, forecasting using ARIMA
 - (b) generalized cost functions, properties of optimal forecast, optimal forecasts for particular models
 - (c) interval forecasts using ARIMA
 - (d) invertibility
 - (e) persistence in forecasting performance
 - (f) multi-step forecast
3. Multivariate Processes
- (a) Some basic concepts, Exogeneity, Persistence, Distributed lags
 - (b) VAR: estimation, testing, forecast error variance decomposition, impulse responses, forecasting
4. Models of Nonstationary Time Series
- (a) spectrum and autocovariance generating function
 - (b) fractional integration and occasional breaks
 - (c) asymptotic theory for deterministic time trends
 - (d) asymptotic theory for unit root processes
 - (e) asymptotic theory for spurious regression
 - (f) asymptotic theory for cointegrated processes
5. Volatility
- (a) ARCH, GARCH
 - (b) multivariate GARCH

- (c) stochastic volatility: realized variance, market microstructure noise, jumps
 - (d) MIDAS
 - (e) forecasting
6. Nonlinear Time Series
- (a) LWG (1993)
 - (b) generalized spectrum: Hong (1999), Hong and Lee (2003)
 - (c) QuickNet: White (2007)
 - (d) nonlinear predictability, diagnostic tests (testing for autocorrelation, dependence, nonlinearity, martingale difference, generalized spectrum), nonlinear models, aggregation, forecasting.
7. Topics in Forecasting 1 (inference)
- (a) Loss functions: Granger (1999, 2002)
 - (b) Diebold and Mariano (1995), West (1996), White (2000), Hansen (2005), Romano and Wolf (2007), Clark and West (2007), Giacomini and White (2006)
 - (c) Density forecast: Diebold et al (1998), Berkowitz (2001), Bao et al (2007), Hong (2001), Hong and Li (2005)
 - (d) optimality (Patton and Timmermann 2007)
 - (e) Out-of-sample test for Granger-causality in mean, in variance, in direction, in density, in quantiles
8. Topics in Forecasting 2 (ensemble methods)
- (a) combined forecasts (Bates and Granger 1969, Timmermann 2007)
 - (b) bagging (Buhlman and Yu, 2002), boosting (Bai and Ng, 2008)
 - (c) model averaging (Hansen 2007), BMA
9. Topics in Forecasting 3 (regularized methods)
- (a) factor models (Stock and Watson, Bai and Ng)
 - (b) PLS, TP
 - (c) LASSO, LARS, EN, ridge regression, pretest estimator
10. Topics in Forecasting 4
- (a) quantile forecast, VaR, extreme values: Bao et al (2006)
 - (b) Interval forecast: Christoffersen (1998)
 - (c) Directional forecast: Christoffersen and Diebold (2006), Hong and Chung (2004)
 - (d) forecasting in panel data
 - (e) model selection and cross-validation in panel data models

REFERENCES

Version 4/1/2008
To be revised (expanded)

1 Textbooks

Granger, C.W.J. and P. Newbold (1986), *Forecasting Economic Time Series*, 2ed., Academic Press.

Hamilton, J. (1994), *Time Series Analysis*, Princeton University Press. ISBN 0-691-04289-6

Tsay, R.S. (2005), *Analysis of Financial Time Series*, 2ed., Wiley. ISBN 0-471-69074-0

2 Nonstationarity

Banerjee, A., J. Dolado, J. Galbraith, and D.F. Hendry (1993), *Cointegration, Error Correction, and the Econometric Analysis of Nonstationary Data*, Oxford University Press.

Engle, R.F. and C.W.J Granger (1991), *Long-Run Economic Relationships*, Oxford University Press.

Engle, R.F. and D. McFadden (1993), *Handbook of Econometrics*, Volume 4, North Holland.

Granger, C.W.J. (1999), *Empirical Modeling in Economics*, Cambridge University Press.

Granger, C.W.J. and P. Newbold (1986), *Forecasting Economic Time Series*, 2ed., Academic Press.

Hamilton, J. (1994), *Time Series Analysis*, Princeton University Press.

Hatanaka, M. (1996), *Time Series-Based Econometrics*, Oxford University Press.

Hendry, D.F. (1995), *Dynamic Econometrics*, Oxford University Press.

Johansen, S. (1995), *Likelihood-Based Inference in Cointegrated Vector Autoregressive Models*, Oxford University Press.

White, H. (2001), *Asymptotic Theory for Econometricians*, revised edition, Academic Press.

Chan, N.H., and Wei, C.Z. (1988), Limiting Distributions of Least Squares Estimates of Unstable Autoregressive Processes, *Annals of Statistics* 16, March 1988, 367-401.

Stock, J.H. (1994), Unit Roots and Trend Breaks, *Handbook of Econometrics*, v. IV

Dickey, D.A., and W.A. Fuller (1979), Distribution of the Estimators for Autoregressive Time Series With a Unit Root, *Journal of the American Statistical Association* 74, no. 366, 427-431.

- Phillips, P.C.B. (1987), Time Series Regression with Unit Roots, *Econometrica*, 55, 277-302.
- Engle, Robert F., and C.W.J. Granger (1987), Co-Integration and Error Correction: Representation, Estimation and Testing, *Econometrica* 55, 251-276.
- Watson, M.W. (1994), Vector Autoregressions and Cointegration, *Handbook of Econometrics*, v. IV, 2844-2915 (sections 1 and 2).
- Johansen, S. (1988), Statistical Analysis of Cointegration Vectors, *Journal of Economic Dynamics and Control*, 12, 231-255.
- Phillips, P.C.B. and S. Ouliaris (1990), Asymptotic Properties of Residual Based Tests for Cointegration, *Econometrica*, 58, 165-94.
- Saikkonen, P. (1991), Asymptotically Efficient Estimation of Cointegrating Regressions, *Econometric Theory*, 7, 1-21.
- Sims, C.A., J.H. Stock, and M.W. Watson (1990), Inference in Linear Time Series Models with Some Unit Roots, *Econometrica* 58, 113-144.
- Stock, J.H. (1987), Asymptotic Properties of Least Squares Estimators of Cointegrating Vectors, *Econometrica* 55, 1035-1056.

3 Volatility

- Tsay, R.S. (2005), *Analysis of Financial Time Series*, 2ed., Wiley.
- Campbell, J.Y., A.W. Lo, and A.C. MacKinlay (1997), *The Econometrics of Financial Markets*, Princeton University Press.
- Engle, R.F. (1995), *ARCH Selected Readings*, Oxford University Press.
- Gourieroux, C. and J. Jasiak (2001), *Financial Econometrics*, Princeton University Press.
- Andersen, T.G., and T. Bollerslev (1998), “Answering the Skeptics: Yes, Standard Volatility Models Do Provide Accurate Forecasts”, *International Economic Review*, 39, 885-905.
- Andersen, T.G., T. Bollerslev, F.X. Diebold and H. Ebens (2001), “The Distribution of Realized Stock Return Volatility”, *Journal of Financial Economics*, 61, 43-76.
- Andersen, T.G., T. Bollerslev, F.X. Diebold, and P. Labys, (2003), “Modelling and Forecasting Realized Volatility”, *Econometrica*, 71, 579-625.
- Andersen, T.G., T. Bollerslev, F.X. Diebold, and P. Labys, (2001) , “The Distribution of Realized Exchange Rate Volatility,” *Journal of the American Statistical Association*, 96, 42-55.
- Andersen, T.G., T. Bollerslev, F.X. Diebold, and P. Labys, (1999), “Realized Volatility and Correlation”.

- Andersen, T.G., T. Bollerslev, F.X. Diebold, and H. Ebens, (2001), “The Distribution of Realized Stock Return Volatility,” *Journal of Financial Economics*, 61, 43-76.
- Ang, A. and G. Bekaert (2002), “International asset allocation with regime shifts”, *Review of Financial Studies*, 15, 1137-1187.
- Ang, A. and J. Chen (2002), “Asymmetric correlations of equity portfolios”, *Review of Financial Studies*, 63, 443-494.
- Awartani, B.M.A. and V. Corradi (2003), “Predicting the Volatility of the S&P-500 Index via GARCH Models: The Role of Asymmetries”, University of Exeter.
- Barndor-Nielsen, O.E. and N. Shephard, (2002), “Econometric Analysis of Realized Volatility and Its Use in Estimating Stochastic Volatility Models”, *Journal of the Royal Statistical Society*, B, 64, 253-280.
- Barndor-Nielsen O.E. and N. Shephard, (2001), “Non Gaussian Ornstein-Uhlenbeck-based Models and Some of their Use in Financial Economics”, *Journal of the Royal Statistical Society*, B, 63, 167-207.
- Bera, A.K. and M.L. Higgins (1993), “ARCH Models: Properties, Estimation, and Testing”, *Journal of Economic Surveys*, 7, 305-366.
- Bollerslev, T. (1990), “Modeling the Coherence in Short-run Nominal Exchange Rates: A Multivariate Generalized ARCH Approach”, *Review of Economics and Statistics*, 72, 498–505.
- Bollerslev, T. (1986), “Generalized Autoregressive Conditional Heteroskedasticity”, *Journal of Econometrics*, 31, 307-327.
- Bollerslev, T. (1987), “A Conditionally Heteroskedastic Time Series Model for Speculative Prices and Rates of Return”, *Review of Economics and Statistics*, 69 (3), 542-547.
- Bollerslev, T., R.Y. Chou, and K.F. Kroner (1992), “ARCH Models in Finance”, *Journal of Econometrics*, 52, 5-59.
- Bollerslev, T., R.F., Engle, and D.B. Nelson (1994), “ARCH Models”, *Handbook of Econometrics*, 4.
- Engle, R.F. (2002), “Dynamic Conditional Correlation: A Simple Class of Multivariate Generalized Autoregressive Conditional Heteroskedasticity Models”, *Journal of Business and Economic Statistics* 20, 339-350.
- Engle, R.F. (1982), “Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of UK Inflation”, *Econometrica*, 50, 987-1008.
- Engle, R.F. and T. Bollerslev (1986), “Modelling the Persistence of Conditional Variances”, *Econometric Reviews*, 5, 1-50.

- Engle, R.F. and Gloria González-Rivera (1991), “Semiparametric ARCH Models”, *Journal of Business and Economic Statistics*, 9 (4), 345-359.
- Engle, R.F. and V.K. Ng (1993), “Measuring and Testing the Impact of News on Volatility”, *Journal of Finance*, 48(5), 1749-1778.
- Engle, R. and K. Sheppard (2001), “Theoretical and Empirical Properties of Dynamic Conditional Correlation Multivariate GARCH”, UCSD Economics Discussion Papers 2001-15, University of California at San Diego, Department of Economics.
- Engle, R. and K. Sheppard (2003), “Asymmetric Dynamics in the Correlations of Global Equity and Bond Returns”, Working Paper No. 204, European Central Bank.
- González-Rivera, G. (1998), “Smooth-Transition GARCH Models”, *Studies in Nonlinear Dynamics and Econometrics*, 3(2), 61-78,
- Nelson, D.B. (1991), “Conditional Heteroscedasticity in Asset Returns: A New Approach”, *Econometrica*, 59(2), 347-370.
- Tse, Y.K. and A.K.C. Tsui (2002), “A Multivariate Generalized Autoregressive Conditional Heteroscedasticity Model With Time-Varying Correlations”, *Journal of Business & Economic Statistics*, July 2002, 351-362.
- Engle, R.F. (2002), “Dynamic Conditional Correlation: A Simple Class of Multivariate Generalized Autoregressive Conditional Heteroskedasticity Models”, *Journal of Business and Economic Statistics* 20, 339-350.
- Engle, R.F. and K.F. Kroner (1995), “Multivariate Simultaneous Generalized ARCH”, *Econometric Theory* 11, 122-50.

4 Nonlinearity

- Tsay, R.S. (2005), *Analysis of Financial Time Series*, 2ed., Wiley.
- Campbell, J.Y., A.W. Lo, and A.C. MacKinlay (1997), *The Econometrics of Financial Markets*, Princeton University Press.
- Granger, C.W.J. and T. Teräsvirta (1993), *Modelling Nonlinear Economic Relationships*, Oxford University Press.
- Fan, J. and Yao, Q. (2003), *Nonlinear Time Series: Nonparametric and Parametric Methods*, Springer Verlag.
- Gourieroux, C. and J. Jasiak (2001), *Financial Econometrics*, Princeton University Press.
- Hong, Y. (1999), “Hypothesis Testing in Time Series via the Empirical Characteristic Function: A Generalized Spectral Density Approach,” *Journal of American Statistical Association*, 84, 1201-1220.

- Hong, Yongmiao and Tae-Hwy Lee (2003a), “Inference on Predictability of Foreign Exchange Rates via Generalized Spectrum and Nonlinear Time Series Models”, *Review of Economics and Statistics*, 85(4), November 2003.
- Hong, Yongmiao and Tae-Hwy Lee (2003b), “Diagnostic Checking for Adequacy of Nonlinear Time Series Models, *Econometric Theory*, 19(6), 1065-1121, December 2003.
- Granger, C. W. J. and T.-H. Lee (1999), “The Effect of Aggregation on Nonlinearity”, *Econometric Reviews*, 18(3), 259-269.
- Lee, T.-H., H. White and C. W. J. Granger (1993), “Testing for Neglected Nonlinearity in Time Series Models: A Comparison of Neural Network Methods and Alternative Tests”, *Journal of Econometrics*, 56, 269-290.

5 Forecasting

- Clements, M.P. and D.F. Hendry (2002), *A Companion to Economic Forecasting*, Blackwell.
- Elliott, G., Granger, C.W.J., and Timmermann, A. (ed.) (2006), *Handbook of Economic Forecasting*, North Holland.

5.1 Loss functions

- Granger, C. W. J. (1969), “Investigating Causal Relations by econometric Models and Cross-Spectral Methods”, *Econometrica*, 37, 424-438.
- Granger, C.W.J. (1969), “Prediction with a Generalized Cost of Error Function”, *Operational Research Quarterly*, 20, 199-207.
- Granger, C. W. J. (1980), “Testing for Causality: A Personal Viewpoint”, *Journal of Economic Dynamics and Control*, 2, 329-352.
- Granger, C. W. J. (1988), “Some Recent Developments in a Concept of Causality”, *Journal of Econometrics*, 39, 199-211.
- Granger, C.W.J. (1989), “Invited Review: Combining Forecasts - Twenty years Later”, *Journal of Forecasting* 8, 167-173.
- Granger, C.W.J. (1999), *Empirical Modeling in Economics*, Cambridge University Press.
- Granger, C.W.J. (1999), “Outline of Forecast Theory Using Generalized Cost Functions”, *Spanish Economic Review* 1, 161-173.
- Granger, C.W.J. (2002), “Some Comments on Risk”, *Journal of Applied Econometrics*, 17, 447-456.
- Granger, C. W. J. (2003), “Time Series Concepts for Conditional Distributions”, *Oxford Bulletin of Economics and Statistics*, 65, 689-701.

- Granger, C. W. J. (2005), “The Past and Future of Empirical Finance: Some Personal Comments”, *Journal of Econometrics*, 129, 35-40.
- Granger, C.W.J. and Ramanathan, R. (1984), “Improved Methods of Combining Forecasts”, *Journal of Forecasting* 3, 197-204.
- Granger, C.W.J. and M.H. Pesaran (2000), “Economic and Statistical Measures of Forecast Accuracy”, *Journal of Forecasting*, 19, 537-560.
- Lee, T.-H. (2006), “Loss Functions”, invited to contribute to International Encyclopedia of the Social Science, 2nd edition (2007), Macmillan Thomson Gale Publishers.
- Granger, C.W.J. and M.J. Machina (2005), “Forecasting and Decision Theory”, forthcoming in *Handbook of Economic Forecasting*, Elliott, G., Granger, C.W.J., and Timmermann, A. (ed.), North Holland.
- Zellner, Arnold (many papers), <http://www.gsb.uchicago.edu/fac/arnold.zellner/more/>

5.2 Comparing Predictive Ability

- *Diebold, F. X. and R. Mariano. 1995. Comparing predictive accuracy. *Journal of Business and Economic Statistics* 13: 253-265.
- Hansen, P. R. 2005. A test for superior predictive ability. *Journal of Business and Economic Statistics* 23: 365-380.
- *West, K. 1996. Asymptotic inference about prediction ability. *Econometrica* 64: 1067-1084.
- *White, H. 2000. A reality check for data snooping. *Econometrica* 68: 1097-1028.
- *Giacomini, R. and H. White (2005), “Conditional Tests for Predictive Ability”, UCLA and UCSD.
- *Clark and West (2006)

5.3 Forecast Optimality

- Christoffersen, P. and F. X. Diebold. 1996. Further results on forecasting and model selection under asymmetric loss. *Journal of Applied Econometrics* 11: 561-572.
- Christoffersen, P. and F. X. Diebold. 1997. Optimal prediction under asymmetric loss. *Econometric Theory* 13: 808-817.
- Granger, C. W. J. 1999a. Outline of forecast theory using generalized cost functions. *Spanish Economic Review* 1: 161-173.
- Granger, C. W. J. 1999b. *Empirical Modeling in Economics*. Cambridge: Cambridge University Press.

Patton, A. and A. Timmermann. 2005. Properties of optimal forecasts. University of California, San Diego.

5.4 Interval Forecast

Christoffersen, P. F. 1998. Evaluating interval forecasts. *International Economic Review* 39: 841-864.

Clements, M.P. and N. Taylor (2003), "Evaluating Interval Forecasts of High-Frequency Financial Data", *Journal of Applied Econometrics*, forthcoming.

5.5 Quantile Forecast

Koenker, R. and Bassett, G. (1978), "Regression Quantiles", *Econometrica*, 46, 33-50.

Komunjer, I. (2005), "Quasi-Maximum Likelihood Estimation for Conditional Quantiles", *Journal of Econometrics*, 128(1), 137-164.

Lee, T.-H. and W. Yang (2006), "Money-Income Granger-causality in Quantiles"

Bao, Y., T.-H. Lee, and B. Saltoglu (2006), "Evaluating Predictive Performance of Value-at-Risk Models in Emerging Markets: A Reality Check", *Journal of Forecasting*

*Tsay, R.S. (2005), *Analysis of Financial Time Series*, 2ed., Wiley.

5.6 Density Forecast

Berkowitz, J. 2001. Testing density forecasts with applications to risk management. *Journal of Business and Economic Statistics* 19: 465-474.

Clements, M. P. and J. Smith. 2000. Evaluating the forecast densities of linear and non-linear models: applications to output growth and unemployment. *Journal of Forecasting* 19: 255-276.

*Diebold, F. X., T. A. Gunther, and A. S. Tay. 1998. Evaluating density forecasts with applications to financial risk management. *International Economic Review* 39: 863-883.

Diebold, F. X., J. Hahn, and A. S. Tay. 1999. Multivariate density forecast evaluation and calibration in financial risk management: high-frequency returns of foreign exchange. *Review of Economics and Statistics* 81: 661-673.

Tay, A. S. and K. F. Wallis. 2000. Density forecasting: a survey. *Journal of Forecasting* 19: 235-254.

Bao, Y. and T.-H. Lee (2006), "Asymmetric Predictive Abilities of Nonlinear Models for Stock Returns: Evidence from Density Forecast Comparison", *Advances in Econometrics*

Bao, Y., T.-H. Lee, and B. Saltoglu (2006), “Comparing Density Forecast Models”, *Journal of Forecasting*

5.7 Forecast Combination

Aiolfi, M. and A. Favero (2002), “Model Uncertainty, Thick Modelling, and the Predictability of Stock Returns”, University of Bocconi.

Aiolfi, M. and A. Timmermann (2004), “Persistence in Forecasting Performance”, UCSD.

*Bates, J.M. and C.W.J. Granger (1969), “The Combination of Forecasts”, *Operations Research Quarterly*, 20, 451-468.

Granger, C.W.J. and Y. Jeon (2004), “Thick Modeling”, *Economic Modelling*, 21, 323-343.

Yang, Yuhong (2004), “Combining Forecasting Procedures: Some Theoretical Results”, *Econometric Theory*, 20, 176-222.

Zou, Hui and Yuhong Yang (2004), “Combining Time Series Models for Forecasting”, *International Journal of Forecasting*, 20, 69-84.

Huang, H. and T.-H. Lee (2006), “To Combine Forecasts or to Combine Information?”

*Timmermann, A. (2005), “Forecast Combinations”, forthcoming in *Handbook of Economic Forecasting*, Elliott, G., Granger, C.W.J., and Timmermann, A. (ed.), North Holland.

Chan, Y.L., Stock, J.H., and Watson, M.W. (1999), “A Dynamic Factor Model Framework for Forecast Combination”, *Spanish Economic Review* 1, 91-121.

Stock, J.H. and Watson, M.W. (1999), “Forecasting Inflation”, *Journal of Monetary Economics* 44, 293-335.

Stock, J.H. and Watson, M.W. (2002a), “Macroeconomic Forecasting Using Diffusion Indexes”, *Journal of Business and Economic Statistics* 20, 147-162.

Stock, J.H. and Watson, M.W. (2002b), “Forecasting Using Principal Components from a Large Number of Predictors”, *Journal of the American Statistical Association* 97, 1167-1179.

Stock, J.H. and Watson, M.W. (2004), “Combination Forecasts of Output Growth in a Seven-Country Data Set”, *Journal of Forecasting* 23, 405-430.

*Stock, J.H. and M.W. Watson (2005), “Forecasting with Many Predictors”, forthcoming in *Handbook of Economic Forecasting*, Elliott, G., Granger, C.W.J., and Timmermann, A. (ed.), North Holland.

5.8 Bagging

Breiman, L. (1996a), “Bagging Predictors”, *Machine Learning*, 24, 123-140.

*Bühlmann, P. and B. Yu (2002), “Analyzing Bagging”, *Annals of Statistics*, 30(4), 927-961.

Lee, T.-H. and Y. Yang (2006), “Bagging Binary Predictors for Time Series”, *Journal of Econometrics*

Stock, J.H. and Watson, M.W. (2005), “An Empirical Comparison of Methods for Forecasting Using Many Predictors”, Harvard and Princeton.

Inoue, A. and Kilian, L. (2006), “How Useful is Bagging in Forecasting Economic Time Series? A Case Study of U.S. CPI Inflation,” University of British Columbia and University of Michigan.

6 Bootstrap

Hall, P. (1992), *The Bootstrap and Edgeworth Expansion*, Springer Verlag. (Chapters 1-3)

Horowitz, J. (2001), “The Bootstrap”, *Handbook of Econometrics*, Vol. 5, North Holland.

Efron, B. and R. LePage (1992), “Introduction to Bootstrap”, in *Exploring the Limits of Bootstrap*, R. LePage and L. Billard (eds.), Chapter 1, 3-10, John Wiley & Sons, Inc.

Hansen, Bruce (2006), *Lecture Notes*, www.ssc.wisc.edu/~bhansen

Spanos, A. (1986), *Statistical Foundations of Econometric Modelling*, Cambridge University Press. (error bounds and asymptotic expansions, pp. 202-208)