SS 223C: Advanced Topics in Econometric Theory
California Institute of Technology
Spring 2006

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Lecture: MW 10:30-11:55 a.m., 218 Baxter
Office Hours: By appointment or open door if available
Secretary: Patricia Hamad (Phone 396-3586, 112 Baxter)

Course Description: This is an *advanced* econometric theory course with particular emphasis on the recent development in time series research. This course examines the models and statistical techniques used to study time series data in economics. The course has two specific objectives. The first is to equip students who anticipate using time series data in their Ph.D. research with the tools they need for state-of-the-art empirical research. The second objective is to lay out the econometric theory of time series analysis, with an emphasis on recent developments. The substantive applications in the course will draw from macroeconomics and finance. All the topics covered in the course are relevant to empirical applications. Prerequisites: SS222A, SS222B, SS222C.

Grading: The course grade will be based on 8 weekly homework problem sets (50%) and a take-home final exam (50%). In order to get a B or higher, all homework assignments as well as the final exam must be completed with a grade of at least 70%. No skipping any homework assignment or exam.

The 8 homework sets will be based on material covered during the week either in lectures or in the reading assignment. Homework sets will have both analytical and computational problems. The computational problems will involve either simulation exercises or exercises involving analysis of real data sets. Many of weekly assignments may be in the form of problem solving and some of them may be simply to require you to read the course materials. (See the preliminary and incomplete draft of some of the problem sets attached at the end of this file.)

The final exam will be designed to check if you have read and understood all the course materials. It is required and expected that you read all the articles and book chapters covered in the lectures. The final exam will take place during the official Caltech Final Examinations for Graduate Students (May 31-June 2). You can pick up the exam from my mailbox after 10 am, Wednesday May 31, 2006. I will also email you the final exam in pdf, at 10 am, the same day. The exam must be returned to me (or under my door) by 5 pm Friday June 2. You may take as much time as you want for the exam (i.e., not timed). Your graded final will be returned to you in your mailboxes in envelops or you can pick up from me in my office by appointment in the following week.

Collaboration Policy: You may collaborate on the homework sets. However, you must write up your own solutions. No copying. You are on your own for the final exam. No collaboration on the exam.

Course Outline:

1. **Nonstationarity:** asymptotic theory for unit root, spurious regression, cointegration, multicointegration, Granger representation, likelihood-based inference, VECM and structural VAR, nonlinearity, forecasting.

2. **Volatility:** ARCH models, multivariate models (BEKK, DCC), stochastic volatility, realized volatility, properties, estimation, testing, forecasting, nonlinearity, long memory.

3. **Nonlinearity:** diagnostic tests (testing for autocorrelation, dependence, nonlinearity, martingale difference, generalized spectrum), nonlinear models, aggregation, forecasting.

4. **Forecasting:** evaluation, comparison, optimality, interval forecast, density forecast, combination (bagging, boosting, Bayesian model averaging), quantile regression, binary quantile regression, extreme values, copula, loss functions.

5. **Bootstrap:** asymptotic expansion, bootstrap consistency, asymptotic refinement, recent developments for dependent time series, subsampling, bagging

FYI: SS222C (also in Spring 2006) covers the *basic* methods and theory of modern time series econometrics while it is also intended to provide a foundation for applied research. More advanced time series econometrics will be treated in SS223C. A few topics may be overlapped in SS222C and SS223C, but the level and theoretical rigor employed in these two courses will be different. SS223C will treat the many topics not touched in SS222C.

REFERENCES

1. 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.

Davidson, J. (1994), *Stochastic Limit Theory*, Oxford University Press.

Davidson, R. and J.G. MacKinnon (2004), *Econometric Theory and Methods,* 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.

Greene, W.H. (2000), *Econometric Analysis,* 4ed., Prentice Hall. (Chapters 5, 11.5)

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.

Maddala, G.S. and I.-M. Kim (1998), *Unit Roots, Cointegration, and Structural Change,* Cambridge University Press.

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

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

Fuller, W. A. (1976), *Introduction to Statistical Time Series*, John Wiley & Sons.

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

Andrews, D.W.K. and H.-Y. Chen (1994), Approximately Median-Unbiased Estimation of Autoregressive Models, *Journal of Business and Economic Statistics*, 12, 187-204.

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.

Elliott, G., T.J. Rothenberg, and J.H. Stock (1996), Efficient Tests for an Autoregressive Unit Root, *Econometrica* 64, 813-836.

Nelson, C.R., and C.I. Plosser (1982), Trends and Random Walks in Macroeconomic Time Series, *Journal of Monetary Economics*, 129-162.

Ng, S. and P. Perron (2001), Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power, *Econometrica* 6, 15191554.

Phillips, P.C.B. (1987), Time Series Regression with Unit Roots, *Econometrica*, 55, 277-302.

Stock, J.H. (1991), Confidence Intervals for the Largest Autoregressive Root in U.S. Economic Time Series, *Journal of Monetary Economics* 28, no. 3, 435-460.

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).

Elliott, G. (1998), The Robustness of Efficient Cointegration Estimators when Regressors Almost Have Unit Roots, *Econometrica* 66, 149-158.

Haug, A.A. (1996), Tests for Cointegration: A Monte Carlo Comparison, *Journal of Econometrics* 71.

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.

Hargreaves, C., ed., (1994), *Nonstationary Time Series Analysis and Cointegration*, Oxford University Press.

2. 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*, 484(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), "Asymetric 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.

Poon, S.-H. and C.W.J. Granger (2002), "Forecasting Volatility in Financial Markets: A Review", Strathclyde University and UCSD, Working Paper.

Riskmetrics (1995), *Technical Manual*, 3ed.

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.

3. Nonlinearity

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.

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

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.

Gloria González-Rivera, Tae-Hwy Lee, and Santosh Mishra (2006), "Jumps in Rank and Expected Returns: Introducing Varying Cross-sectional Risk,"

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.

4. 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.

4.1. 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/

4.2. 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. 2001. An unbiased and powerful test for superior predictive ability. Working paper, Brown University.

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)

4.3. 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.

4.4. 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.

4.5. 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 (2006a), "Granger-causality in quantiles"

Lee, T.-H. and W. Yang (2006b),

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.

4.6. Density Forecast

Bao, Y., T.H. Lee, and B. Saltoglu (2004), "A Test for Density Forecast Comparison with Applications to Risk Management".

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*

4.7. 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.

4.8. Bagging

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

Breiman, L. (1996b), "Heuristics of Instability and Stabilization in Model Selection", *Annals of Statistics*, 24(6), 2350–2383.

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 and Kilian (2005)

5. 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)