

**ECO 5428-01**  
**Time Series Analysis**  
Spring 2008  
TR 3:55—4:50 PM  
219 HCB

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**Course Materials** The required text for the class is *Analysis of Financial Time Series, 2<sup>nd</sup> edition*, by Ruey S. Tsay (Wiley, 2005). This is not a particularly advanced text but it includes an excellent selection of topics that you should find useful even beyond this class. Another good text that I have used in the past is *Applied Econometric Time Series, 2<sup>nd</sup> edition*, by Walter Enders (Wiley, 2004). Enders' text covers fewer topics of interest to financial economists but covers the basics such as ARIMA models in a bit more detail with more examples than Tsay. A more advanced reference is *Time Series Analysis* by James Hamilton (Princeton University Press, 1994). Hamilton is a bit dated now but it is an excellent reference for the details that are often omitted from Tsay and Enders. Finally, John Cochrane of the University of Chicago has written an excellent set of notes that are available on the web. I will post the web address on the class blackboard page.

**Course description and objectives:** The primary objective of this course is to introduce you to the basic univariate and multivariate time series techniques used for economic and financial analysis. A secondary objective is to help you become comfortable with the computer skills necessary to keep up with the ever-changing methods of time series analysis. I presume that everyone is at familiar with basic probability theory, statistical inference and regression analysis

I will use the class blackboard page to make course announcements, distribute homework, and distribute supplemental readings. You will find a supplemental reading list attached to this syllabus. If you are considering a field in econometrics, you should read all or at least most of the articles on this supplemental reading list.

We cover a lot of material in this class so it is very important that you keep up with the reading and the homework. I will not discuss every topic

in the text and I will focus on examples in class. You should read the material in advance and come to class prepared to discuss the chapter and ask questions about the material. If you do not have questions I will assume that you understand the material and I will move on to the next topic.

**Software:** We will use the R statistical software package in the class. R is part of the GNU free software project and is rapidly becoming a standard for statistical computing. Essentially, R is a public domain version of the S-Plus commercial software package. R runs on most common platforms. I will post the web page on the class blackboard page.

**Grading:** Your grade will be determined by for 50% homework and 50% for quizzes.

*Homework:* I will ask you to form groups of 2 to 4 for the homework exercises. Everyone in the group will receive the same score. Most exercises will involve estimating a model using R. For example, I will ask each group to estimate a GARCH and GARCH-in-mean model for some stock return and to prepare a brief report of their results. We will discuss these results in class and you may have to defend your methodology. There are likely to be 5 or 6 of these exercises.

*Quizzes:* During the semester I will give about 6 or 7 one or two problem quizzes over the analytical material of the course. These quizzes will be announced and I will try to give you a good idea of the type of problem to expect. The quizzes will be given at the beginning of the class and you will have 20 minutes to solve the problem. We will go over the solutions immediately after the quiz. I will allow you to drop your lowest quiz score before computing your course grade. I will not give make-up quizzes.

There will be no final exam in this class.

**FSU Honor Code:** Academic dishonesty will not be tolerated in any form. Students involved in academic dishonesty will receive a failing grade in the course. The Academic Honor system of the Florida State University is based on the premise that each student has the responsibility to: (i) uphold the highest standards of academic integrity in the student's own work, (ii) to refuse to tolerate violations of academic integrity in the university community, and (iii) to foster a high sense of integrity and social responsibility on the part of the university community.

Please see the following web site for a complete explanation of the Academic Honor Code:

<http://www.fsu.edu/Books/Student-Handbook/codes/honor.html>

You should be aware that I take the honor code very seriously. If I discover

you cheating on an exam I will give you a zero and report you to the Dean of Students with a recommendation that you be expelled from the university.

**American Disabilities Act:** Students with disabilities needing academic accommodations should: (1) register with and provide documentation to the Student Disability Resource Center (SDRC); (2) bring a letter to the instructor from SDRC indicating that you need academic accommodations. This should be done within the first week of class.

For more information about services available to FSU students with disabilities, contact the Student Disability Resource Center.

**Syllabus Change Policy:** This syllabus is a guide for the course and is subject to change with advanced notice.

**Approximate Course Schedule:**

<b>Week</b>	<b>Date</b>	<b>Day</b>	<b>Topics</b>	<b>Reading</b>
1	1/8 1/10	T R	Characteristics of returns ACF & white noise	ch. 1 ch. 2.1–3
2	1/15 1/17	T R	Spectral Analysis Spectral Analysis	Notes Notes
3	1/22 1/24	T R	AR & MA ARMA	ch. 2.4–5 ch. 2.6
4	1/29 1/31	T R	ARMA Unit Roots	ch. 2.6 ch. 2.7
5	2/5 2/7	T R	Unit Roots Seasonal & Long Memory	ch. 2.7 ch. 2.8–11
6	2/12 2/14	T R	ARCH GARCH	ch. 3.1–4 ch. 3.5
7	2/19 2/21	T R	Other GARCH Stochastic Volatility & Kurtosis	ch. 3.6–9 ch. 3.12, 3.16
8	2/26 2/28	T R	Multivariate & Intervention Models Transfer Function Models	ch 8.1, Notes Notes
9	3/4 3/6	T R	VAR VAR	ch. 8.2 ch. 8.2
10	3/11 3/13	T R	SPRING BREAK SPRING BREAK	
11	3/18 3/20	T R	VAR Cointegration	ch. 8.3–4 ch. 8.5–6
12	3/25 3/27	T R	Cointegration VECM	ch. 8.5–6 ch. 8.6
13	4/1 4/3	T R	State Space Kalman Filter	ch. 11.1–3 ch. 11.4–7
14	4/8 4/10	T R	Markov Chain Monte Carlo Markov Chain Monte Carlo	ch. 10 ch. 10
15	4/15 4/17	T R	Topics Topics	ch. 6, 7, 9 ch. 6, 7, 9

## Supplemental Reading List

These readings will give you a better background for some topics. I expect students who plan getting a field in Applied Econometrics to read these additional articles. I will announce in class which articles will be covered by quizzes.

### 1. Univariate methods (ARIMA models).

- Hamilton (*Time Series Analysis*, Princeton Univ. Press, 1994.) chapters 1, 2, 3, 4, 5.
- Percival, D. B. Three curious properties of the sample variance and autocovariance for stationary processes with unknown mean. *The American Statistician*, November 1993, Vol. 47, No. 4, pp. 274–276.
- Pukkila, T., Koreisha, S. and Kallinen, A. The identification of ARMA models. *Biometrika*, 1990, Vol. 77, No. 3, pp. 537–548.
- Hassler, U. and Wolters, J. Long memory in inflation rates: international evidence. *Journal of Business & Economic Statistics*, January 1995, Vol. 13, No. 1, pp. 37–46.

### 2. Spectral Analysis.

- Hamilton chapter 6.
- Granger, C. W. J. The typical spectral shape on an economic variable. *Econometrica*, 1966, Vol. 34, No. 1, pp. 150–161.

### 3. Transfer function models.

- Box, G. E. P., and Tiao, G. C. Intervention analysis with applications to economic and environmental problems. *Journal of the American Statistical Association*, 1975, Vol. 70, No. 3, pp. 70–79.
- Chung, C. and Liu, L-M. Joint estimation of model parameters and outlier effects in time series. *Journal of the American Statistical Association*, 1993, Vol. 88, No. 421, pp. 284–297.
- McCain, L. J. and McCleary, R. The statistical analysis of the simple interrupted time-series quasi-experiment. In *Quasi-experimentation: design and analysis issues for field settings*, eds., T. D. Cook and D. Campbell, Houghton Mifflin, Boston, 1979, pp. 233–293.

- Orwin, R. G., Schucker, R. E., and Stokes, R. C. Evaluating the life cycle of a product warning: saccharin and diet soft drinks. *Evaluation Review*, December 1984, Vol. 8, No. 4, pp. 801–822.
- Thompson, P. A. and Noordewier, T. Estimating the effects of consumer incentive programs on domestic automobile sales. *Journal of Business & Economic Statistics*, October 1992, Vol. 10, No. 4, pp. 409–417.

4. Vector autoregressions (VAR) and causality testing.

- Hamilton chapters 10, 11 and 12.
- Sims, C. A. Macroeconomics and reality. *Econometrica*, January 1980, Vol. 48, No. 1, pp. 1–48.
- Cooley, T. F. and LeRoy, S. F. Atheoretical Macroeconomics: a critique. *Journal of Monetary Economics*, 1985, Vol. 16, pp. 283–307.
- Runkle, D. E. Vector autoregressions and reality. *Journal of Business & Economic Statistics*, October 1987, Vol. 5, No. 4, pp. 437–454.
- Todd, R. M. Improving economic forecasting with Bayesian vector autoregression. *Federal Reserve Bank of Minneapolis Quarterly Review*, Fall 1984, pp. 18–29.
- Todd, R. M. Vector autoregression evidence on monetarism: another look at the robustness debate. *Federal Reserve Bank of Minneapolis Quarterly Review*, Spring 1990, pp. 19–37.
- Granger, C. W. J. Investigating causal relations by econometric models and cross-spectral models. *Econometrica*, 1969, Vol. 37, pp. 424–438.
- Sims, C. A. Money, income, and causality. *American Economic Review*, 1972, Vol. 62, pp. 540–552.

5. Nonstationarity and unit root tests.

- Hamilton chapters 15, 16 and 17.
- Cochrane, J. H. A critique of the application of unit root tests. *Journal of Economic Dynamics and Control*, 1991, Vol. 15, pp. 275–284.

- Dickey, D. A., Bell, W. R., and Miller, R. B. Unit roots in time series models: tests and implications. *The American Statistician*, February 1986, Vol. 40, No. 1, pp. 12–26.
- Dickey, D. A. and Pantula, S. G. Determining the order of differencing in autoregressive processes. *Journal of Business & Economic Statistics*, October 1987, Vol. 5, No. 4, pp. 455–461.
- Dolado, J. J., Jenkinson, T. and Sosvilla-Rivero, S. Cointegration and unit roots. *Journal of Economic Surveys*, 1990, Vol. 4, No. 3, pp. 249–273.
- Phillips, P. C. B. and Xiao, Z. A primer on unit root testing. *Journal of Economic Surveys*, 1998, Vol. 12, No. 5, pp. 423–469.
- Rudebusch, G. The uncertain unit root in real GNP. *American Economic Review*, March 1993, Vol. 83, No. 1, pp. 264–272.
- Stock, J. H. Unit roots, structural breaks and trends. Chapter 46 in *Handbook of Econometrics, Volume IV*, eds. R. F. Engle and D. L. McFadden, Elsevier Science, 1994, pp. 2739–2841.

6. Cointegration and vector error correction models (VECM).

- Hamilton chapters 18, 19 and 20.
- Alogoskoufis, G. and Smith, R. On error correction models: specification interpretation, estimation. *Journal of Economic Surveys*, 1991, Vol. 5, No. 1, pp.97–128.
- Campbell, J. Y. Does saving anticipate declining labor income? An alternative test of the permanent income hypothesis. *Econometrica*, November 1987, Vol. 55, No. 6, pp. 1249–1273.
- Dickey, D. A., Jansen, D. W. and Thornton, D. L. A primer on cointegration with an application to money and income. *The Federal Reserve Bank of St. Louis Review*, March/April 1991, Vol. 73, No. 2, pp. 58–78.
- Murray, M. P. A drunk and her dog: an illustration of cointegration and error correction. *The American Statistician*, February 1994, Vol. 48, No. 1, pp. 37–39.

7. Conditional heteroscedasticity models (GARCH).

- Hamilton chapter 21.

- Bollerslev, T., Chou, R. Y., and Kroner, K. F. ARCH modeling in finance: a review of the theory and empirical evidence. *Journal of Econometrics*, 1992, Vol. 52, pp. 5–59.
- Bollerslev, T., Engle, R. F., and Nelson, D. B. ARCH models. Chapter 49 in *Handbook of Econometrics, Volume IV*, eds. R. F. Engle and D. L. McFadden, Elsevier Science, 1994, pp. 2959–3037.