

## *Course Syllabus*

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**Eco 7378  
Special Topics in Econometrics  
Spring 2012**

**Prof. Tom Fomby  
TTh 2:00 – 3:20 PM  
303 Lee**

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### **Purpose of Course:**

This course is designed to teach multivariate time series techniques and present various applications of the techniques.

### **Student Learning Objectives:**

#### **The student will learn**

- **the nature of spurious regressions and their effects on time series analysis**
- **how to test for unit roots in time series and for cointegration of time series**
- **how to conduct Granger causality tests and Chow Stability tests and their implications for time series modeling**
- **how to construct an autoregressive distributed lag (ARDL) time series model and analyze the implied interim and total multiplier effects implied by the model**
- **how to estimate equal-lag-length, Bayesian, and Factor Augmented VARs**
- **how to use VARs and out-of-sample forecasting experiments to validate a proposed leading indicator**
- **how to estimate and forecast with an Error Correction model in the presence of cointegrated time series**
- **how to conduct variance decomposition and impulse response analyses of multiple time series using VARs**

### **Textbooks:**

The primary textbook for the course is Modeling Financial Time Series with S-Plus (2<sup>nd</sup> edition, 2006) by Eric Zivot and Jiahui Wang (hereafter referred to as **ZW**). A supplementary textbook I will sometimes refer to is New Introduction to Multiple Time Series Analysis (2006) by Helmut Lutkepohl (hereafter referred to as **HL2**). The primary software package we will be using is SAS but on occasion we may wind up using S-PLUS with finmetrics. Both of these software packages

are available in our computer labs and, in the case of SAS, downloading on your personal laptop or PC.

### **Evaluation of Student:**

The evaluation in the class consists of three parts:

- Term Paper of approximately 20 pages on an applied multivariate time series topic in economics or finance (50%). The term paper is to be turned in on the last day of classes (Thursday, April 26).
- One 20 – 30 minute PowerPoint classroom presentation on the term paper topic chosen by the student (25%). These will be presented in the two class meetings before the last day of classes.
- Assigned Exercises (25%)

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### **Additional Details**

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**Classroom Website:** <http://faculty.smu.edu/tfomby/>

**Office:** Room 301M, Umphrey Lee, 214-768-2559. E-mail address: [tfomby@smu.edu](mailto:tfomby@smu.edu)

**Office Hours:** Tuesday and Thursday 3:30 – 5:00PM or by appointment.

**Teaching Assistant:** Yingyuan Lin. E-mail address: [yingyuanl@smu.edu](mailto:yingyuanl@smu.edu)

### **Important Dates to Remember:**

**First Day of Class:** Tuesday, January 17

**Spring Break:** March 10 – 18, Saturday - Sunday

**Last Day to Drop a Class:** Wednesday, April 4

**University Holiday – Good Friday:** April 6

**Last Day of Instruction in this class:** Thursday, April 26

**Excused Absences for University Extracurricular Activities:**

Students participating in an officially sanctioned, scheduled University extracurricular activity will be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with me prior to any missed scheduled examination or other missed assignment for making up the work.

**Disability Accommodations:**

Students needing academic accommodations for a disability must first contact Ms. Rebecca Marin, Coordinator, Services for Students with Disabilities (8-4557) to verify the disability and establish eligibility for accommodations. They should then schedule an appointment with the professor to make appropriate arrangements (See University Policy No. 2.4).

**Religious Observance:**

Religiously observant students wishing to be absent on holidays that require missing class should notify me in writing at the beginning of the semester, and should discuss, in advance, acceptable ways of making up any work missed because of the absence (See University Policy No. 1.9).

**Honor Code:**

All SMU students are bound by the Honor Code (see SMU Student Handbook for a complete discussion of the SMU Honor Code). The code states that “any giving or receiving of aid on academic work submitted for evaluation, without the express consent of the instructor, or the toleration of such action shall constitute a breach of the Honor Code.” A violation can result in an “F” for the course and an Honor Code Violation on your transcript.

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## COURSE OUTLINE

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### I. Introduction

- A. This Course is Follow-up to the Univariate Time Series Course
- B. The Major Purposes of this course

References: Class Notes

### II. The Spurious Regression Phenomenon in Time Series Analysis

- A. Simulations of Spurious Regressions
- B. Results of Simulations
- C. Theoretical Findings of Phillips (1986)
- D. Unbalanced Equations

Reference: **ZW**, pp. 432 – 435.

### III. Dickey-Fuller Unit Root Tests

- A. Nature of Unit Root Processes
- B. Three Cases: Three test equations
- C. SAS PROC ARIMA

Reference: **ZW**, Chapter 4

### IV. An Overview of Bivariate Time Series Modeling

- A. A Useful Decision Tree
- B. Discussion

Reference: Class Notes

### V. Some Data Sets we are going to examine

- A. Box and Jenkins' Series M Data Set
- B. Term Structure of Interest Rates: 3-month versus 6-month T-bill interest Rates
- C. Texas Economy and Oil Price Data Set
- D. The Woodflooring Industry Data Set
- E. Stock Market Returns
- F. Pindyck and Rubinfeld Heating Oil Data Set

Reference: Class Notes

VI. Equal Lag Length VAR

- A. Notation and Assumptions
- B. Stationarity Requirement of VAR
- C. Either Trends and Seasonal Dummies or Ordinary and/or Seasonal Differencing to achieve Stationarity
- D. Lag Length Selection – System-Wide Goodness-of-Fit Measures
- E. Forecasting
- F. Example: The Series M Data Set

Reference: **ZW**, Chapter 11, pp. 385 – 409. Chapter 2, sections 1 and 2 in **HL2**

VII. An Examination of Levels versus Differenced VARs

- A. A Discussion of the VARMA Simulator, VARMAXSIM, in Proc VARMAX
- B. The Results of Five Simulations
- C. The Stylized “Facts” Drawn from the Simulations
- D. Importance of Pre-testing for Unit Roots, Co-integration, and Causality

Reference: Proc VARMAX Documentation on VARMAXSIM

VIII. Tests of Causality and Stability

- A. Chow Test of Stability
- B. Granger Test of Causality
- C. Application: Series M data set

References: A. Chapter 4, section 6 in **HL2**, B. Chapter 11, section 4.1 in **ZW**.  
Also Chapter 3, section 6, and Chapter 4, section 2.2 in **HL2**.

IX. Using a VAR and an Out-of-Sample Forecasting Experiment to determine the ability of a supplementary variable to aid in the forecasting of a target variable

- A. The Nature of Out-of-Sample Forecasting Experiments
- B. The Diebold-Mariano test of significant difference in forecasting Accuracies
- C. Getting Extra Leverage in using a Restricted VAR (RVAR)
- D. Application: Series M data set

X. Bayesian VARs

- A. Minnesota (Litterman) Priors
- B. Forecasting with BVARs
- C. Choosing Tightness of Priors by Out-of-Sample Validation

References: Section 6 in Chapter 11 in **ZW**. Also: A. Chapter 7, section 4 in **HL2**, B. Class Discussion, C. Class Discussion

XI. Factor Augmented VARs (FAVARs)

- A. State Space Models
- B. Factor Augmented VARs
- C. Kalman Filter and MLE
- D. Applications: Stock Market Returns and Pindyck and Rubinfeld Heating Oil Data Set
- E. Out-of-Sample Comparisons

References: Chapter 14 in **ZW**. Also Chapter 18 in **HL2**.

XII. Cointegration and Error Correction Models (ECMs)

- A. Definition of Cointegration
- B. Granger Representation Theorem
- C. Testing for Cointegration
  - i. Engle/Granger Single Equation Tests
  - ii. Johansen Tests (Trace and Max-Eigenvalue tests)
- D. Forecasting with ECM
- E. Term Structure of Interest Rate Example
- F. Out-of-Sample Validation

References: Chapter 12, **ZW**. Also Chapter 6, sections 1 – 6 and Chapter 8 in **HL2**.

XIII. VARX Models and Company Scenarios

- A. Notation
- B. National Wood Flooring Manufacturers' Data
- C. Deterministic Trend and Deterministic Seasonals
- D. Multipliers and Mean Response Analysis
- E. Forecasting and Scenario Playing with VARX Models
- F. Out-of-Sample Validation and the Ashley Criterion

Reference: Sections 1 – 5 in Chapter 6, **ZW**. Also Chapter 10 in **HL2**.

XIV. VARs and Innovation Accounting

- A. Wold Infinite VMA Representation of Stationary VARs.
- B. Structural VARs and Their Impulse Response Functions
  - i. Choleski Decomposition
  - ii. Sims (1986) and Bernanke (1986)
  - iii. Blanchard and Quah (1989)
- C. Impulse Response Functions for ECM Models
- D. Error Variance Decompositions
- E. An Example: The Texas Economy and Oil Prices

Reference: Sections 4.2 and 4.3 in Chapter 11 of **ZW**. Also Chapter 9 in **HL2**.