

COURSE APPROVAL DOCUMENT

Southeast Missouri State University

Department: Mathematics

Course No. MA575

Title of Course: Time Series and Forecasting

Date: Fall 2015

Please check: New

Revision

I. Catalog Description (Credit Hours of Course):

Introduction to financial time series analysis with hands-on estimation of mean and conditional heteroscedastic processes using statistical software. (3)

II. Prerequisite (s):

MA425 with a minimum grade of 'C' and MA145 with a minimum grade of 'C'

III. Purposes or Objectives of the Course (optional):

The objectives of this course are for students to empirically model, analyze, and forecast financial time series.

IV. Student Learning Outcomes (Minimum of 3):

A. Students will be able to build a time series model for return series and use the fitted model to produce step-ahead forecasts.

B. Students will be able to check and apply remedial techniques to correct serial correlation in regression models with time series errors.

C. Students will be able to build ARCH and GARCH models for log return series and use the fitted model to compute volatility forecasts and their corresponding standard errors.

V. Optional departmental/college requirements:

None

VI. Course Content or Outline (Indicate number of class hours per unit or section):

| Topics | Class hours |
|--|-------------|
| 1. Financial Time Series and Their Characteristics | 9 hours |
| a. Asset Returns | |
| b. Distributional Properties of Returns | |
| c. Processes Considered (Volatility and Extreme Returns) | |
| 2. Linear Times Series Analysis and Its Applications | 16 hours |
| a. Stationarity | |
| b. Correlation and Autocorrelation Function | |
| c. White Noise and Linear Time Series | |
| d. Simple AR Models | |
| e. Simple MA Models | |
| f. Simple ARMA Models | |
| g. Unit-Root Nonstationarity | |
| h. Seasonal Models | |
| i. Regression Models with Time Series Errors | |
| j. Consistent Covariance Matrix Estimation | |
| k. Long-Memory Models | |
| 3. Conditional Heteroscedastic Models | 12 hours |
| a. Characteristics of Volatility | |

- b. Structure of a Model
 - c. Model Building
 - d. The ARCH Model
 - e. The GARCH Model
 - 4. Multivariate Time Series and Its Application (Optional) 6 hours
 - a. Weak Stationarity and Cross-Correlation Matrix
 - b. Vector Autoregressive Models
 - 5. Exams 2 hours
- Total hours: 45**

Please Attach copy of class syllabus and schedule as an example

Signature: _____ Date: _____
Chair

Signature: _____ Date: _____
Dean

MA575-01
Time Series and Forecasting
Fall 2015
JH101, MW 11:00—12:15pm

INSTRUCTOR: Pradeep Singh

OFFICE: 303A, Johnson Hall

PHONE #: (573) 651-2773

E-MAIL: psingh@semo.edu

SKYPE ID: pradeep.singh10

OFFICE HOURS: 10:00 – 11:00am, 2:30 -3:30pm MW; 9:00 – 11:00am F; or by

I. Catalog Description and Credit Hours of Course

Introduction to financial time series analysis with hands-on estimation of mean and conditional heteroscedastic processes using statistical software. (3)

II. Prerequisite or Co-requisite

MA425 with a minimum grade of 'C' and MA145 with a minimum grade of 'C'

III. Objectives of Course

The objectives of this course are for students to empirically model, analyze, and forecast financial time series.

IV. Expectations of Students

The students are expected to participate in classroom activities, do assignments, complete projects, and pass examinations.

V. Student Learning Outcomes

- A. Students will be able to build a time series model for return series and use the fitted model to produce step-ahead forecasts.
- B. Students will be able to check and apply remedial techniques to correct serial correlation in regression models with time series errors.
- C. Students will be able to build ARCH and GARCH models for log return series and use the fitted model to compute volatility forecasts and their corresponding standard errors.

VI. Course Content

| | Hours |
|--|--------------|
| 4. Financial Time Series and Their Characteristics | 9 hours |
| d. Asset Returns | |
| e. Distributional Properties of Returns | |
| f. Processes Considered (Volatility and Extreme Returns) | |
| 5. Linear Times Series Analysis and Its Applications | 16 hours |
| l. Stationarity | |
| m. Correlation and Autocorrelation Function | |
| n. White Noise and Linear Time Series | |
| o. Simple AR Models | |
| p. Simple MA Models | |
| q. Simple ARMA Models | |
| r. Unit-Root Nonstationarity | |
| s. Seasonal Models | |
| t. Regression Models with Time Series Errors | |
| u. Consistent Covariance Matrix Estimation | |
| v. Long-Memory Models | |
| 6. Conditional Heteroscedastic Models | 12 hours |

| | | |
|---------------|---|-----------------|
| f. | Characteristics of Volatility | |
| g. | Structure of a Model | |
| h. | Model Building | |
| i. | The ARCH Model | |
| j. | The GARCH Model | |
| 5. | Multivariate Time Series and Its Application (Optional) | 6 hours |
| c. | Weak Stationarity and Cross-Correlation Matrix | |
| d. | Vector Autoregressive Models | |
| 6. | Exams | 2 hours |
| Total: | | 45 hours |

VII. Suggested Textbook

Tsay, R.S. (2010): Analysis of Financial Time Series, (Third Edition), John Wiley & Sons.

VIII. Basis of Student Evaluation

| Undergraduate | | Graduate | |
|----------------|-----|---------------------|-----|
| A. Assignments | 20% | A. Assignments | 15% |
| B. Class Tests | 40% | B. Class Tests | 40% |
| C. Projects | 20% | C. Projects | 15% |
| D. Final Exam | 20% | D. Graduate Project | 10% |
| | | E. Final Exam | 20% |

Important Dates: Friday, November 20, 2015 by 5:00 pm is the last day to drop a full semester class or withdraw from the university without failing grades. The Mathematics Department Chairperson and the College of Science, Technology, and Agriculture Dean do not make exceptions to this deadline. Wednesday, December 16, 10am – noon is the comprehensive final exam for this course. Any student who does not take the final exam will earn an “X” (failing and non-attending) for this course.

Class Policies:

- As elementary education mathematics course, much of the value comes from communicating about mathematics through participation in class activities and discussions. Students are expected to attend class and engage in classroom activities. Students who know in advance that they will be absent should arrange to get assignments and schedule any necessary make-ups. However, some activities and associated points cannot be made up and absent students will simply earn a zero for the assignment. **For full or partial credit, students are expected to participate in all classroom activities.**
- **MyLabsPlus Practice may be completed past the due date for 70% credit. A 30% penalty will be deducted only on those exercises scored after the due date. The deadline for submitting any MyLabsPlus practice assignments will be at class time on the day of the final exam.**
- **Missed paper quizzes may not be made up.**
- **You may make up one hour examination by contacting me as soon as possible, prior to the exam. Missed exams must be made up prior to my returning to their return, usually the following class period. I must return tests to students in a timely manner. If a test is graded and returned to students, you lose the right to make up the test. Missed exam make-up appointments will result in the loss of the right to take the exam.**

Accessibility Plan. Southeast Missouri State University will take such means as are necessary to insure that no qualified disabled person is denied the benefits of, excluded from participation in, or otherwise subject to discrimination because Southeast Missouri State University’s facilities are physically inaccessible to, or unusable by disabled persons. The accessibility standard required by Federal law for ‘existing facilities’ is that the recipient’s program or activities when viewed in its entirety, must be readily accessible to disabled persons.

Southeast Missouri State University may meet this standard through such means as reassignment of classes, or other services to accessible locations, redesign equipment, assignment of aides, alterations of existing facilities, and construction of new accessible facilities. Southeast Missouri State University is not required to make structural changes in existing facilities where other methods are sufficient to comply with the accessibility standard described above.

Because scheduling classes, coordinating accommodations, and arranging housing in accessible facilities may require reasonable advance planning, students with disabilities accepted for admission should identify themselves and their disability within five days of the start of the semester of enrollment and indicate the nature of accommodation needed for their disability.

For more information, see the [Disability Support Services](#) page or contact Disability Support Services, room 302, University Center, One University Plaza ms1300, Cape Girardeau, MO 63701; (573)651-2273.

Academic Honesty. Academic honesty is one of the most important qualities influencing the character and vitality of an educational institution. Academic misconduct or dishonesty is inconsistent with membership in an academic community and cannot be accepted. Violations of academic honesty represent a serious breach of discipline and may be considered grounds for disciplinary action, including dismissal from the University.

Academic dishonesty is defined to include those acts which would deceive, cheat, or defraud so as to promote or enhance one's scholastic record. Knowingly or actively assisting any person in the commission of an above-mentioned act is also academic dishonesty.

Students are responsible for upholding the principles of academic honesty in accordance with the "University Statement of Student Rights" found in the STUDENT HANDBOOK. The University requires that all assignments submitted to faculty members by students be the work of the individual student submitting the work. An exception would be group projects assigned by the instructor. In this situation, the work must be that of the group. Academic dishonesty includes:

Plagiarism. In speaking or writing, plagiarism is the act of passing someone else's work off as one's own. In addition, plagiarism is defined as using the essential style and manner of expression of a source as if it were one's own. If there is any doubt, the student should consult his/her instructor or any manual of term paper or report writing. Violations of academic honesty include:

1. Presenting the exact words of a source without quotation marks;
2. Using another student's computer source code or algorithm or copying a laboratory report; or
3. Presenting information, judgments, ideas, or facts summarized from a source without giving credit.

Cheating. Cheating includes using or relying on the work of someone else in an inappropriate manner. It includes, but is not limited to, those activities where a student:

1. Obtains or attempts to obtain unauthorized knowledge of an examination's contents prior to the time of that examination;
2. Copies another student's work or intentionally allows others to copy assignments, examinations, source codes or designs;
3. Works in a group when she/he has been told to work individually;
4. Uses unauthorized reference material during an examination; or
5. Have someone else take an examination or takes the examination for another.

General Responsibilities for Academic Honesty. It is the University's responsibility to inform both students and faculty of their rights and responsibilities regarding such important matters as

cheating and plagiarism. Most of what is considered unethical or dishonest behavior can be avoided if faculty and students clearly understand what constitutes such practices and their consequences. The University community should also be aware of the procedures to be followed should a breach of academic honesty occur.

The faculty member is responsible for clarification to his/her class of those standards of honesty for class assignments or functions where such standards may be unclear or when such standards vary from the accepted norm. Further, some faculty may choose to utilize preventive measures (multiple exams, alternate seating, etc.) to help insure the maintenance of academic honesty. However, the use of such measures is the prerogative of the individual faculty member and is not a responsibility or requirement of faculty in general.

The fundamental responsibility for the maintenance of honesty standards rests upon the student. It is the student's responsibility to be familiar with the University policy on academic honesty and to uphold standards of academic honesty at all times in all situations.

Cheating on a test or assignment will result in a zero for that activity and may result in referral to the Dean of Students. Repeated violations will be referred to the Dean of Students with possible disciplinary action being taken at the University level. Students are encouraged to work together to study and do problems for this course, but each student is expected to turn in work that represents his or her own effort. During a quiz or test no homework or notes should be visible. All electronic devices will be stowed in pocket, purse, or backpack. Devices may not be on worktable or in lap.

Protocol for Adjudicating Alleged Violations of Academic Honesty. Faculty members who discover evidence of academic dishonesty should contact the student within five business days of discovering the alleged dishonesty to arrange to meet and discuss the allegation. Prior to this meeting the faculty member may consult with the Department Chairperson, the appropriate Dean, and the Office of Judicial Affairs. The following sections describe the procedures to be adhered to in each of the listed instances: the student acknowledges the violation, the student denies the violation, and the appeals process. If the faculty member is the Department Chairperson, a departmental designee will assume the Department Chairperson's role in this protocol and references to the Department Chairperson should be read as departmental designee. The procedures below should be followed with online, ITV or face-to-face classes.

Civility and Harassment: A major determinant of a successful educational experience is a shared sense of respect among and between the students and their instructor. Some of the texts and issues we will discuss may cause disagreements among members of the class. Multiple viewpoints are an essential component of any college course, and disagreeing with someone is fine. However, rude, disrespectful, aggressive, offensive, harassing, or demeaning behavior—either face-to-face or in an online discussion—toward anyone in the class will not be tolerated; students are expected to abide by the Code of Student Conduct (<http://www6.semo.edu/stuconduct/code.html>). Should a student feel someone has acted inappropriately toward them in class, please speak with the instructor at once so the situation can be addressed. The instructor for the course reserves the right to ask a student to leave the classroom or the online discussion for any inappropriate behavior, and if the situation warrants, may call campus security to remove the offending student from class.

Getting Help: There is no shame in needing help in any university course; seek help immediately so as to not fall behind:

- **Attend your instructor's office hours.**
- **Visit the Math Learning Center in Johnson Hall 112 or Memorial Hall 104 where a mathematics tutor is available 9 am to 5 pm Mondays through Thursdays and Friday 9 am to 2 pm. Johnson Hall 112 is even open late on Tuesday and Thursday – until 7:30pm.**

- **Sign up for a free tutor from the Learning Assistance Programs in the University Center, (573) 651-2512, <http://www.semo.edu/sss/>**
- **Get counseling for math anxiety, test anxiety, personal problems from the University Counseling Services (573) 986-6191, <http://www.semo.edu/ucs/>.**
- **Students who have a documented disability should meet with their instructor early in the semester to discuss accommodations.**

Classroom Conduct: Diversity in all its form is valued and merits respect. A major determinant of a successful educational experience is a shared sense of respect among students and their instructor. In our classroom, mutual respect will be maintained at all times, both in word and deed. To minimize disruption to your fellow classmates, please remember not to leave the classroom until class is dismissed, not to carry on personal conversations unrelated to the topic at hand, and turn off cell phones.

Use your Southeast email account: You are responsible for the information in any Southeast e-mail sent by any Southeast employee. When you email, for your own protection, use your Southeast account.

Questions?: Questions, comments, or requests regarding this class should be directed to the Department of Mathematics Chairperson, Dr. Tamela Randolph. Unanswered questions or unresolved issues involving this class may be taken to Dr. Chris McGowan, Dean, College of Science, Technology, and Agriculture.