

University of Texas at Arlington  
Department of Economics  
Class Meeting: W, 7:00-9:50pm  
Professor C.Y. Choi

Office: COBA 316  
Office Hrs: M,W 1:30-2:30 p.m.  
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## **ECON 5338 / BSAD 6315 Applied Time Series / Time Series**

### **Course Description:**

As one of the fastest growing fields in econometrics in the last two decades, time series analysis has been widely used in economics to study the dynamic structure of economic variables and to probe the dynamic relationship between variables. The goal of this course is to provide a foundation in essential time series methods that will allow students to read empirical economic literature and to use econometric software to undertake their own empirical analysis of economic data. Emphasis is put on empirical applications, but some theoretical topics are covered when needed. The course concentrate on time series topics that have been popular and widely used in economics, including stationary ARMA models, GMM, VAR, unit-roots/cointegration, dynamic panel data models, ARCH, and nonlinear models. Since the focus of this course is mostly on the time domain analysis, spectral analysis will not be discussed. Students will spend time in the computer lab where they will apply the techniques they learn to a variety of the data, including 'DataStream'.

Prerequisites: *ECON 5336* with **intellectual curiosity and strong willingness to learn**

### **Student Learning Outcomes:**

Upon completion of this course, students will be

- (1) familiar with basic and advanced time series models with up-to-date empirical techniques;
- (2) able to analyze economic data by using econometric software such as R, Eviews, and Stata;
- (3) able to practice the techniques by writing a research paper and presenting it.

### **Course Material**

#### **1. Textbooks:**

Though there is no one textbook exactly matches the material covered in class, the following textbook is the closest to our course objectives.

*“Applied Econometric Times Series”*, Walter Enders, 3<sup>rd</sup> edition, Wiley, 2010 (**required**)

Other useful references include:

*“Analysis of Financial Time Series”*, 3<sup>rd</sup> ed., Ruey S. Tsay, Wiley, 2010.

“*Econometric Methods*”, 4<sup>th</sup> ed., Jack Johnston and John DiNardo, McGraw-Hill, 1997.

“*Time series: theory and methods*”, Peter J. Brockwell, Richard A. Davis; Springer-Verlag, 1991.

“*Time Series Analysis*”, James Hamilton, Princeton University Press, 1994. (*advanced*)

“*Econometrics*”, Fumio Hayashi, Princeton University Press, 2000. (*advanced*)

“*Handbook of Econometrics*”, vols.2, 4 and 5, Elsevier. (*advanced*)

“*Non-linear Time Series Models in Empirical Finance*”, PH Frances and D van Dijk, Cambridge Univ. Press, 2000.

“*The Econometrics of Financial Markets*”, Campbell, Lo and Mackinlay, Princeton Univ. Press, 1997.

## 2. Computer software and related materials:

“*Using Eviews for Undergraduate Econometrics*”, 2<sup>nd</sup> ed. (2001), Reiman, M. and Hill, R.C., John Wiley & Sons. (This handbook provides a guide to learning the software EViews using the examples in the text and should come bundled with Eviews Student Version software.)

“*The Eviews software (student version)*”: You can purchase this online at <http://www.eviews.com/>.

“*Brief introduction on Using Eviews*”:

<http://www.econ.ucdavis.edu/faculty/jorda/class/140/Eviews.htm>

“*Useful Primer to EViews and other resources*”:

“<http://faculty.washington.edu/ezivot/eviews.htm>”

## Course Website:

The course website is available in the UTA Blackboard interface (<http://elearn.uta.edu>). Since the website will serve as a storehouse of course information (course syllabus, course materials, announcements, links to relevant websites, practice problems and answer keys, and grade information, etc.), it is **your responsibility** to check the course website as often as you can.

## Course Requirements and Grading Policy:

<i>Evaluations</i>	<i>Date</i>	<i>Weight</i>
Homework	Four assignments (TBA)	<b>12 percent</b>
Computer HW	Weekly assignment	<b>12 percent</b>
Mid-term	March 4, Wednesday (tentative)	<b>25 percent</b>
Final exam	May 13, Wednesday (8:15-10:45 pm)	<b>25 percent</b>
Research project	See the table on the last page	<b>20 percent</b>
Class participation	Throughout the semester	<b>6 percent</b>

- Course Grade: Your course grade will be given based on the **weighted** average of the exams and quizzes using the formula of

Your total score = average homework score  $\times$  0.24 + mid-term score  $\times$  0.25 + final exam score  $\times$  0.25 + research project score  $\times$  0.20 + Class participation.

For example, if you got 73 in the mid-term, 83 in the final exam, 78 in the research project, the average of the five homework scores is 86, and the class participation point of 5. Then your total score will be 81.1 ( $= 73 \times 0.25 + 83 \times 0.25 + 78 \times 0.20 + 86 \times 0.25 + 5$ ).

Then letter grades then will be given according to the following scale:

A = 90.0 and above	C = 70.0 - 79.9	F = 59.9 and below
B = 80.0 - 89.9	D = 60.0 - 69.9	

- **Exams:** Due to the inherent unfairness, there will be **no make-up exam** unless you miss an exam for a valid reason (see below for the penalty waivers). *If there is any question about the grading of the mid-term examination, you have one week to submit the examination with a specific issue after the examination is returned.* **The Final Exam** will be **cumulative**. You must take the final to receive a course grade.
- **Penalty Waivers:** I will waive the penalty on a missed exam only for the following reasons on condition that you provide me a valid document. (only for one mid-term exam).
  - (a) You have a valid medical excuse (**doctor's medical statements in official coverletter with signature are required**)
  - (b) you are a student athlete traveling to competition
  - (c) you are in the armed forces reserves and are called out of town
  - (d) family emergencies.
- When I grade exam answers **you EARN points – you do not LOSE points**. You start every exam with a zero (not 100) and build your points upon what is included on the exam.
- There will be no bargaining for grades. Also, there will be no post-course opportunity to do “extra work” to raise your grade. *But, the instructor reserves the right to adjust final course grades based upon class participation.*

## **Software:**

To my experience, econometrics is best learned by doing. A number of computer activities will be expected throughout the course. Though there is no restriction on the choice of software package, I strongly recommend you to use R-package (<http://www.r-project.org/>) which is a very convenient programming language for econometric and statistical analysis (see also here <http://cran.r-project.org/doc/manuals/R-intro.pdf>). More importantly, it is free. Other commercial packages like EVIEWS can be used for the class, but it is not as flexible and powerful as the R-package. EVIEWS is a windows based “point and click” time series program that is greatly useful, and quite easy to use and can be purchased directly from <http://www.eviews.com>. SAS is

also a useful software for empirical analysis. GAUSS and Matlab are programming language-based software and hence slightly more challenging to use, but without doubt more powerful.

### **Grade Grievances:**

You have one calendar year from the date the grade is assigned to initiate any grievance. The normal academic channels are department chair, academic dean, and the Provost.

### **Drop Policy:**

It is the student's responsibility to complete the course or withdraw from the course in accordance with University Regulations. Students are strongly encouraged to verify their grade status before dropping a course after the first withdrawal date. A student who drops a course after the first withdrawal date may receive an "F" in the course if the student is failing at the time the course is dropped. (**April 3, 2015 is the last drop date**)

### **College Policy:**

Students who have not paid by the census date and are dropped for non-payment cannot receive a grade for the course in any circumstances. A student dropped for non-payment who continues to attend the course will not receive a grade for the course. Emergency loans are available to help students pay tuition and fees through the Bursar's Office.

### **Academic Integrity:**

Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

*I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule 50101, §2.2*, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. No unauthorized assistance may be used when taking exams. **Any academic dishonesty will result in a grade of "F" for the course.**

### **Americans with Disabilities Act:**

If a student requires an accommodation based on disability, the student should meet with the instructor in his/her office during the first week of the semester. As a faculty member, I am required by law to provide "reasonable accommodation" to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with informing

faculty at the beginning of the semester and in providing authorized documentation through designated administrative channels.

### **Student Support Services:**

The University of Texas at Arlington supports a variety of student success programs to help you connect with the University and achieve academic success. They include learning assistance, developmental education, advising and mentoring, admission and transition, and federally funded programs. Students requiring assistance academically, personally, or socially should contact the Office of Student Success Programs at 817-272-6107 for more information and appropriate referrals.

### **Bomb Threats:**

If anyone is tempted to call in a bomb threat, be aware that UTA will attempt to trace the phone call and prosecute all responsible parties. Every effort will be made to avoid cancellation of presentations/tests caused by bomb threats. Unannounced alternate sites will be available for these classes. Your instructor will make you aware of alternate class sites in the event that your classroom is not available.

### **Evacuation Procedures:**

In the event of an evacuation of the College of Business building, when the fire alarm sounds, **everyone must leave the building by the stairs.** With the fire alarm system we now have, the elevators will all go to the first floor and stay there until the system is turned off.

FOR DISABLED PERSONS.....please go to the Northeast fire stairs. We have an evacuation track chair located on the 6<sup>th</sup> floor stairwell. We have people trained in the use of this chair and there will be someone that will go to the 6<sup>th</sup> floor to get the chair and bring it to any lower floor stairwell to assist disabled persons.

### **E-Culture Policy:**

The University of Texas at Arlington has adopted the University email address as an official means of communication with students. Through the use of email, UT-Arlington is able to provide students with relevant and timely information, designed to facilitate student success. In particular, important information concerning registration, financial aid, payment of bills, and graduation may be sent to students through email.

All students are assigned an email account and information about activating and using it is available at [www.uta.edu/email](http://www.uta.edu/email). New students (first semester at UTA) are able to activate their email account 24 hours after registering for courses. There is no additional charge to students for using this account, and it remains active as long as a student is enrolled at UT-Arlington. Students are responsible for checking their email regularly.

I encourage and welcome students to contact me by email (using the proper salutation) with questions they may have relevant to the course material, economics, or life in general. I generally respond to emails within one day. Questions emailed to me related to course material will be answered by email and distributed to all students in the class. I will not name the student asking the question(s).

When you contact me via e-mail, please make sure that your full name with proper capitalization and ECON 5338 or BSAD 6315 appear in the 'Sender' and in the 'Subject' line. Due to the concern on computer viruses, I often delete suspicious e-mails without even opening them.

### **Classroom Protocol (DOs and DO NOTs):**

Because lots of (exciting and interesting) materials are going to be covered in a short period of time, it is vital for all of us to cooperate in using the given time as efficiently as possible.

- BE **ON TIME** to every class meeting and conduct yourself appropriately when the class is called to order. I expect students to sit the entire class. If you need to leave class early, please let me know before the class starts and seat yourself close to the door.
- DO check the course website on a regular basis.
- DO ask questions and ask me to slow down if I'm going too fast or if material is not clear.
- DO help out the class by initiating and participating in class discussion. I will frequently call on students to discuss course topics. Please help us maintain a pleasant, scholarly atmosphere. Your questions and comments during class help not only yourself, but others to learn and understand. **Active class participation** will be appreciated and reflected in your grade positively in the event that a student is on the border between grades.
- DO seek out help **early** if you are having problems. I will be available outside office hours if you email or call me in advance so as to schedule a mutually convenient time.
- DO prepare for this class at least twice a week by reviewing your notes, recopying your notes, supplementing notes with text material, working with other students, and coming to my office hours or emailing me questions about the material. Your study habits, attitudes toward course work, strategies for preparation for class and for performance may need to change if you would like to see an improvement in your performance in this course and in other courses in general.
- Do NOT talk amongst yourselves, play palm pilot, play computer, or read the newspaper during class. If you need to use computer for note-taking purpose, you are supposed to get me a notice from doctors.
- DO NOT involve in academic misconduct. Academic misconduct includes, but not limited to, giving or receiving information during an exam, submitting plagiarized work for academic requirements or submitting altered documentation.

### **Some hints on Note-Taking and Studying:**

- *Use of split-page:* Draw a line down the middle of a page in your notebook. Take notes during class on the left hand side of the page. After class, **review** your notes line by line. If you understand what you have written during class, use the right hand side of the page to correct and embellish it, and express it **in your own words**. If you don't understand what you have written, underline it, and ask about it during office hours or send an e-mail. You will learn more than you imagine by **translating the material into your own words**.

- *Active learning*: If you don't understand something, ask questions. Also try to figure out where the instructor is heading in his lecture by asking yourselves, "If I were the instructor, what materials would I present next to provide a clear and logical picture?"
- *Study group*: It is a good idea to form a study group with your classmates to exchange ideas and information (of course not during exams). It will be helpful to identify potential examination questions and formulate answers for them.

### Course Schedule

Topics	Class Assigned	Reading List
<ul style="list-style-type: none"> <li>• Basic concepts of time series analysis               <ul style="list-style-type: none"> <li>- Features of time series data</li> <li>- Frequency domain and time domain</li> </ul> </li> </ul>	1	Enders: Ch 1.1 HE (v.2): Ch 17
<ul style="list-style-type: none"> <li>• ARMA processes               <ul style="list-style-type: none"> <li>- Difference equation and lag operators</li> <li>- ACF and PACF</li> <li>- Box-Jenkins approach</li> <li>- Forecasting using ARMA model</li> <li>- Seasonality</li> <li>- Stationarity</li> </ul> </li> </ul>	3	Enders: Ch 1.2~1.9 and Ch 2.1~2.9
<ul style="list-style-type: none"> <li>• Estimating time series models               <ul style="list-style-type: none"> <li>- LS estimators and small sample bias</li> <li>- Generalized method of moment (GMM)</li> </ul> </li> </ul>	1	Hayashi: Ch 1,3,8
<ul style="list-style-type: none"> <li>• Modeling volatility               <ul style="list-style-type: none"> <li>- ARCH and GARCH</li> <li>- Variants of GARCH</li> <li>- Estimation of GARCH models</li> </ul> </li> </ul>	1	Enders: Ch 3 HE (v.4) Ch 49
<ul style="list-style-type: none"> <li>• Nonstationary time series               <ul style="list-style-type: none"> <li>- Deterministic and stochastic trends</li> <li>- Various models of random walk</li> <li>- ARIMA model</li> <li>- Removing trend</li> <li>- Trend and business cycle</li> <li>- Trend-cycle decomposition</li> <li>- Fractional integration and long memory</li> </ul> </li> </ul>	3	Enders: Ch 4.1~4.3 HE (v.4) Ch 46.1~4
<ul style="list-style-type: none"> <li>• Unit-root tests               <ul style="list-style-type: none"> <li>- Univariate unit-root tests</li> <li>- Asymptotic properties of test statistics</li> <li>- Panel unit-root tests</li> </ul> </li> </ul>	3	Enders: Ch 4.5~4.11 HE (v.4) Ch 46.1~4
<ul style="list-style-type: none"> <li>• Vector Autoregressions (VAR)               <ul style="list-style-type: none"> <li>- Representation and estimation</li> <li>- Impulse response function and variance Decomposition</li> <li>- Granger causality</li> </ul> </li> </ul>	4	Enders: Ch 5.1~5.10 HE (v.4) Ch 47.2,4

- Structural VAR		
<ul style="list-style-type: none"> <li>• Cointegration and error correction models <ul style="list-style-type: none"> <li>- Cointegration</li> <li>- Long-run economic equilibrium</li> <li>- Cointegration and common trends</li> <li>- Error correction model (ECM) and VECM</li> <li>- Testing for cointegration</li> </ul> </li> </ul>	3	Enders: Ch 6 HE (v.4) Ch 47.3
<ul style="list-style-type: none"> <li>• Nonlinear time series models <ul style="list-style-type: none"> <li>- Types of nonlinear models</li> <li>- Structural breaks</li> <li>- TAR and STAR models</li> <li>- Markov switching model</li> <li>- Testing for nonlinearity</li> <li>- Unit-root and nonlinearity</li> </ul> </li> </ul>	3	Enders: Ch 7 HE (v.4) Ch 48

\* HE represents the Handbook of Econometrics series.

### **Important Info regarding Research Paper**

Date	Event
March 18	Select topic and methodologies. Submit a (written) progress report including data collection.
April 29	Draft of paper is due.
May 6	Presentations.
May 8	Final version of paper is due. Late papers will face a penalty.
Evaluations	Meeting deadlines in each stage: 20% Quality of topic and paper: 40% Presentation: 40%