Macroeconomic Forecasting   Fall 2016

Syllabus

Course Number:	440.615.81
Instructor:	John Schindler
Email:	jschind3@jhu.edu
Office Hours:	By appointment. I will be in Switzerland until the end of October, so it is very difficult to find a convenient time for the class as a whole. If you make an appointment, I can 'meet you' in the class Adobe Connect site: http://connect.johnshopkins.edu/schindler/

WARNING: This class is very demanding. There will be many demands on your time. In addition, there are no recorded lectures. If a topic is giving you difficulty, please contact me.

Purpose:	The purpose of this course is twofold. First, to understand the theoretical underpinnings of modern macroeconomic forecasting. Second, to learn to estimate and use a wide variety of macroeconomic forecasting models. The focus is clearly on the second purpose, but little progress could be made without also pursuing the first purpose.
Grading:	Your grade will be determined by your performance on **6** homework assignments, **6** quizzes, **6** interactive exercises, and a final project. Each of these four items will count for one quarter of your grade. There are no make-up assignments or quizzes, but I will allow you to drop the two lowest of your 18 homework, quiz and interactive assignment grades. In accordance with the Program's policy, your final letter grade will be assigned on a curve with roughly half the class receiving grades in the A range and roughly half the class receiving grades in the B range. Cs are possible.
Textbook:	Elements of Forecasting, Francis X. Diebold, Fourth Edition. Available in pdf format for free at: http://www.ssc.upenn.edu/~fdiebold/Teaching221/FullBook.pdf
Prerequisites:	In addition to any course requirements established by the university, you must be comfortable with the basics of time series analysis taught in introductory econometrics courses and you must be conversant in macroeconomic theory.
Computing Requirements:	The homework assignments will require you to do computer work. It should be possible to do these homework assignments with a number of software packages, and any software output will be accepted. I recommend EVIEWS, because it was specifically designed for the work that we will be doing, and it is what I will use in all of the instruction and output I give you. EVIEWS is available in the AAP computer labs. You can purchase Eviews at an extremely deep discount price (roughly $95 plus S&H). To order it, go here: http://shop.ihs.com/buy/en/ihs/software/software-eviews/academic-eviews-9-enterprise-edition-stand-alone The standard version of Eviews should suffice as well, but the free version will give you problems. I am proficient in EVIEWS and can help with most problems you encounter using EVIEWS. **I will not be able to help you with problems you encounter in other software packages.**

Course Elements

Units: Our coverage of the material will be divided into six units, and we will spend two weeks on each unit. Each unit will begin on a Monday and end at midnight on the second subsequent Sunday. Each unit consists of assigned material to read, a set of powerpoint slides that present a brief overview/summary of that unit's material, a quiz, a homework assignment, and an interactive assignment. The latter is the primary learning tool in the class.

Office Hours: These will be held by appointment. As I will be in Switzerland until the end of October, it is almost impossible to find a time that works for a broad set of students. However, we can arrange a call or an Adobe Connect session at a mutually agreeable time. To set this up, email me. The Adobe Connect room is accessible through this link: http://connect.johnshopkins.edu/schindler/

Email: I am always available by email (jschind3@jhu.edu), but please allow 24-48 hours for a response. In the event that an answer is detailed or complicated, I may record an answer and send you a link to the recording or suggest that we meet in the Adobe Connect room.

Slides: Each unit includes a short powerpoint presentation that highlights some of the material from the book and includes some narration that presents anecdotes, commentary, etc. These slides are meant as a complement to the text. They are not intended to be a replacement for reading the text, nor are they intended to be equivalent to an in-class lecture. (There is no equivalent to that in this online class). As some of you may be using different editions of the textbook, the chapter references in the slides may differ from the textbook you have. Please let me know if you have any question about the chapter references in the slides.

Homework: There is a homework assignment for every unit, for a total of six. Homework assignments are always due by the end of the second week of the unit, and no late submissions will be accepted for any reason. (Leave it for the last day or so of the unit at your own risk.) For example, unit #1 homework assignments are due by the end of the second course week (Sunday by midnight). Homework assignments will be applications of the material in the text. All assignments must be submitted as a single Word document with the document named as follows "lastname_hmwk#" or "lastname1lastname2etc_hmwk#" for group submissions. Please email the file to me directly at jschind3@jhu.edu. Do not submit it through the course website.

Typically the assignments will require you to do forecasting exercises using econometric software. You will be graded on the completion of all of the questions, the proper use of the correct forecasting techniques and methodologies, and the quality of your written and graphic answers. For example, if the assignment calls for you to include a graph, I expect the graph to look nice and to be pasted into your final document, not attached as a separate file. Also, if the assignment asks you to explain something, I will look for accuracy and brevity (e.g., it is better to explain something accurately in two sentences than in four, and I assure you that any future boss you have will appreciate it). In this sense, I am treating you as I would one of my employees and expecting you to perform to a very high level in terms of forecasting competence and presentation of the material.

Homework assignments will be graded on a scale from 0 to 100. Each question on the homework is assigned points. If a particular question is worth 10 points, then roughly three points will be based on presentation (e.g., clarity and brevity of answers, quality of graphs, etc.). A 3 would indicate no problems with presentation. A 2 would indicate only minor problems with presentation. A 1 would indicate major problems with presentation. For this ten point question example, seven points will be based on the use of proper forecasting technique and

methodology. A 7 will indicate successful completion of all of the question with no problems in methodology. A 6 will indicate some minor problems. A 5 will indicate some significant problem (e.g., significant errors or a minor error on an important concept) or multiple minor problems. A 4 or less will indicate multiple significant problems and/or many minor problems. Students who do not complete that question will receive a 0.

I require students to work on homework assignments in groups of two to four students. I have found that students working in groups did better than students working on their own, and students who worked in groups reported that they felt they learned more.

When working in a group, please submit only one assignment and make sure all of the names are on the assignment, e.g. lastname1lastname2lastname3lastname4_hmwk#. Please let me know the names of the people working together BEFORE you work begin working together. **If any problems arise within the group (e.g. someone in the group is not doing any work), please let me know ASAP.**

Quizzes: The quizzes are extremely challenging, and the class average is typically about 80 percent. This is done on purpose to make the quizzes a thinking exercise and not merely regurgitation of memorized material.

The quizzes are timed (most will allow up to 2 hours, although most students use well under half that time), and you can take them at any time during the given unit. You can use any resources available to you aside from classmates. QUIZZES ARE TO BE DONE ALONE – NO ASSISTANCE FROM CLASSMATES IS PERMITTED. They are designed to test your knowledge of the material presented in the text and in the recorded overviews, as well as the knowledge gained through the interactive assignments. There are a total of six quizzes.

Answers to the quiz questions may require some thought, but you should not overthink these questions.

Quiz grades will be recorded as a percentage, e.g. 9 out of 10 is 90 percent.

Interactive
Assignments: These assignments are the primary learning tool of the class. These are assignments in which you will be given material and asked to do something with it. These assignments will be done in groups, which I will assign, and the groups will change every one or two units. The assignments will usually be posted from Tuesday of the first week of the unit (usually around 10 am) until Thursday of the second week of the unit. The posting may change in some units owing to holidays, etc.

The idea is for the group as a whole to determine what is good and bad about the material you are shown and to figure out how to improve it. In many cases, you will be given the data and asked to improve on the output that is shown.

Your grade on these assignments will be based on the quality and quantity of your participation.

You are required to participate in a substantive manner on four days spread out throughout the ten days in which the assignment is active. To be counted toward your four days, each post must be separated by at least 24 hours. If you participate on fewer than four days, your grade will be marked down.

You should not participate on more than four days. This is to assure that others have a chance to make substantive contributions to the assignment. It also means that you should make each contribution count.

If your participation is not spread out throughout the ten days, your grade will be marked down. For example, if you participate on the first four days and then do not participate again that week, your grade will be marked down. This is to assure that you see all aspects of the assignment.

Participation more than once in a day will only count as participation once. You can post as much as you like in a day, but it will only count as a single day of participation. (That is, if you participate at 10am and then again at 3pm, I will only count that as participation on a single day.) If you have comments on lots of things, you can still include all of those thoughts in a single post or a group of smaller posts, but it will only count as participation in a single day. The group will not make sufficient progress in one day to warrant you making additional contributions. In general, I have found that your classmates appreciate it if you combine all of your thoughts for the day into a single post as it reduces clutter in the discussion area.

You should insert all charts, graphs, and tables into your post. DO NOT post them as attachments. This will save everyone time by letting them see the item you are talking about and not having to search for it. Your grade will be marked down if you do not insert these items into your posts. For Eviews charts and graphs, the best way to insert things is to take a screenshot of the graph, crop it, and insert it as a picture into the post.

Your posts should be substantive. That means that your posts should help your group get closer to the solution. You should be posting new charts, graphs, regressions, alternative versions of the model, etc. You can also comment on other people's models, charts, etc., but in that case, you should implement your suggestions for improving the models, charts, etc. i.e. if you point out a problem or an area for improvement, then don't just tell us how to do it better, SHOW US!

Some common mistakes students make include just posting questions, posting suggestions for improving the model but not putting those suggestions into practice, or posting criticisms of other people's posts but not actually implementing and posting the corrected regressions, charts, etc. (Anyone can find an error in someone else's work, but it's only substantive if you post the correct material.)

The grading of the interactive assignments will be on a scale of 0 to 100. Someone who does not making any substantive contributions in a week will receive a zero. Someone who makes one substantive contribution in a week will receive a 50. Someone who makes two substantive posts in a week will receive a 75. Someone who makes three substantive posts will receive an 85. Someone who makes four substantive posts will receive a 95. Each unit I will select a few students who I feel have made the most important contributions and award them a 100. I am the sole determiner of whether a post is substantive. (I do recognize that this is subjective.)

Final Project: Consistent with the applied nature of this program and this course, instead of a final exam every group (see below) will be required to submit a final project.
The project will consist of the selection of a macroeconomic series of interest, discussion of the series' properties, estimation of a reasonable forecasting model for the series, discussion of the process used to select that model, production of a forecast for that series using the selected model, and discussion of the forecast. Experience suggests that the best students are able to do

this in 10 pages or less. Usually students who submit longer assignments do not know what is important or relevant and what is not and hence they run every test and try every model indiscriminately. That said, there is no specific page count I am looking for.

You may work in groups or on your own on this project. Groups should consist of between two and four people. Typically people just use their homework groups for this.

Projects will be graded on a scale of 0 to 100. There will be three elements to the grade: your forecasting skill as demonstrated by properly selecting an appropriate forecasting model and carrying out the appropriate diagnostics to ensure that your selected model is good, your presentation of your work, and your contribution to the group.

By the beginning of unit 6 (see calendar) at the latest, you should have sent me the series and received approval for the series that you wish to forecast. For example, a series that trends upward deterministically showing little or no seasonality or cyclicality might not be approved because it will not challenge your forecasting skills. A series that follows a stochastic trend with large cycles and obvious seasonality will be approved.

Forecasting skill (70 percent of your grade): This grade will be based on your demonstration of your knowledge of proper forecasting technique. Did you run all of the appropriate diagnostics? Based on those tests, were your decisions correct? Are there any problems with the model you selected?

Presentation (30 percent of your grade): Have you selected all of the necessary graphs and output to illustrate your work, i.e. did you include the necessary charts and tables to support your conclusions, did you include unnecessary charts and tables or perform unnecessary diagnostic tests, are the charts well formatted, were you clear and brief? How well did you describe your work?

Group contribution (possible adjustment to your grade): When your project has been submitted, each member of the group should send me an email in which they tell me which member of their group (if any) they feel contributed the most to the project and which member(s) (if any) did not contribute their fair share. Based on those evaluations, each person's grade may be adjusted by up to five points based on their group member's assessment.

IMPORTANT: No assignments will be accepted late and no makeup quizzes will be offered! You have the full schedule already and two weeks to complete each assignment/quiz. If you choose to leave the completion of some activity until the last minute and then get sick, that is a risk you take. You will be allowed to drop the two lowest grades from among the 18 quiz, homework, and interactive assignments grades (2 out of 18 grades) to compensate you for the no makeup policy.

University Ethics Statement:

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any violations you witness to the instructor.

COURSE CALENDAR

August
29	Unit 1 begins
30	Interactive assignment for unit 1 starts

September
8	Interactive assignment for unit 1 ends
11	Quiz 1 and homework 1 must be completed by midnight
12	Unit 2 begins
13	Interactive assignment for unit 2 starts
22	Interactive assignment for unit 2 ends
25	Quiz 2 and homework 2 must be completed by midnight
26	Unit 3 begins
27	Interactive assignment for unit 3 starts

October
6	Interactive assignment for unit 3 ends
9	Quiz 3 and homework 3 must be completed by midnight
10	Unit 4 begins
11	Interactive assignment for unit 4 starts
20	Interactive assignment for unit 4 ends
23	Quiz 4 and homework 4 must be completed by midnight.
24	Unit 5 begins
25	Interactive assignment for unit 5 starts

November
3	Interactive assignment for unit 5 ends
5	Groups for the final project must be determined by this date
6	Quiz 5 and homework 5 must be completed by midnight
7	Unit 6 begins
8	Series for the final project must be approved by this date
8	Interactive assignment for unit 6 starts
17	Interactive assignment for unit 6 ends
20	Quiz 6 and homework 6 must be completed by midnight
21	THANKSGIVING BREAK BEGINS
27	THANKSGIVING BREAK ENDS

December
2	Final Project is due

Unit #1

Material Covered:	Chapter 1: Introduction to Forecasting
	Chapter 2: A Brief Review of Probability, Statistics, and Regression for Forecasting
	Chapter 3: Six Considerations to Successful Forecasting
	Chapter 4: Statistical Graphics for Forecasting

Objectives:
1. Review material on regression on your own.
2. Get comfortable with the online tools we will use in this course
3. Learn the basic forecasting terminology and principles.
4. Learn to evaluate and produce effective graphs using an econometrics software package.
5. Get comfortable with the basics of the econometric software you have chosen to use.

Interactive Assignment: Comment and improve on the posted graphs. Comments should include suggesting improvements, noting the most appealing aspects of the graphs, and commenting on the suggestions made by classmates. The data used to construct the graphs are provided, so you should put some of your comments into action and post improved graphs. Graphs will change throughout the week, so check back to make further comments. The goal should be for the class to agree upon graphs that best portray the data. If you do not think there is anything worth commenting on (e.g., it's all been said before), then post a link to a graph that you find online that you think could use some improvement and make some suggestions.

Homework Assignment: See website

Quiz: Basic forecasting terminology and principles (i.e., the "six considerations")

Eviews Knowledge: Basics of creating workfiles
Importing data/copying data
Basics of series manipulation
Basics charts and chart editing

Unit #2

Material Covered: Chapter 5: Modeling and Forecasting Trend
Chapter 6: Modeling and Forecasting Seasonality

Objectives: 1. Understand the theory behind trend and seasonality models
2. Estimate and use simple trend models to make forecasts
3. Estimate and use simple models of seasonality to make forecasts
4. Select between competing forecasting models
5. Use judgmental forecasting techniques to modify models

Interactive Assignment: Comment on time series graphs that are posted. What type of deterministic trend models would you use to estimate these series? Do the series exhibit seasonality? What seasonality models would you suggest using? When diagnostics are later posted, comment on what the tests indicate about the correct choice for modeling. Comment on other peoples' suggestions with the goal of determining the correct models for the series. If you do not think there is anything worth commenting on (e.g., it's all been said before), then post a link to a time series graph that you find online and comment on how you would model that series.

Homework Assignment: See website

Quiz: Different types of trend models, AIC and SIC and the advantages and disadvantages of each, different models of seasonality

Eviews Knowledge: Running basic regressions
Constructing seasonal dummies
Constructing trend variables

Unit #3

Material Covered:	Chapter 7: Characterizing Cycles
	Chapter 8: Modeling Cycles: MA, AR, and ARMA Models

Objectives:
1. Understand the theorems and concepts that are crucial to time series modeling (covariance stationarity, Wold's Theorem, the general linear process, rational distributed lags)
2. Understand the theory behind the basic time series model (ARMA)
3. Learn to identify and estimate the best time series model for a given series
4. Use judgment forecasting techniques to modify models

Interactive Assignment: Look at the graphs posted. Discuss whether you think the models are AR, MA, or ARMA models based on visual examination of the series. Later, when diagnostic tests are posted, discuss the best way to model the series based on the tests. As always, comment on other peoples' suggestions with the goal of the class achieving the correct answer. If you do not think there is anything worth commenting on (e.g., it's all been said before), then post a link to a time series graph that you find online and suggest ways to model the series.

Homework Assignment: See website

Quiz: Covariance stationarity, white noise, Wold's Theorem, general linear process, rational distributed lags, autocorrelation and partial autocorrelation functions, MA processes, AR processes, ARMA processes

Eviews Knowledge: Running regressions with AR and MA terms
Constructing correlograms

Unit #4

Material Covered:	Chapter 9: Forecasting Cycles
	Chapter 10: Putting It All Together: A Forecasting Model with Trend, Seasonal and Cyclical Components

Objectives:

1. Understand what makes a forecast optimal for AR and MA processes
2. Understand recursive techniques
3. Make optimal forecasts using ARMA models that include trend and seasonality
4. Use recursive techniques to diagnose problems with forecast models and to select between competing forecast models
5. Use judgmental forecasting techniques to modify models

Interactive Assignment: Use the data to come up with the model that generates the best forecast. Instead of looking at in sample performance, we are going to look at the out of sample performance of the models in order to choose the best model. Those out of sample techniques may include recursive techniques such as recursive cross validation. Comment on the forecast models of your classmates and make suggestions for improvement. The goal is for the class to come up with the best possible forecast of the series shown. If you do not think there is anything worth commenting on (e.g., it's all been said before), then post the output from a forecast that you make (it does not have to be a perfect forecast) and comment on it.

Homework Assignment: See website

Quiz: Forecast optimality, recursive techniques, parameter instability, cross validation

Eviews Knowledge: Constructing static and dynamic forecasts
Performing a CUSUM analysis
Using recursive techniques
Optional: Writing small programs to run loops

Unit #5

Material Covered:	Chapter 11: Forecasting with Regression Models
	Chapter 12: Evaluating and Combining Forecasts

Objectives:
1. Be able to explain the various sources of forecast error
2. Be able to explain transfer function models and the distinctions between them
3. Estimate a VAR model and create impulse response functions for the estimated model
4. Measure the accuracy of a given forecast and compare the accuracy to competing forecasts
5. Be able to describe the optimal properties that a forecast should have

Interactive Assignment: Examine the VAR output and graphs. Suggest ways to improve the VARs. Later, when the forecasts are changed based on the class suggestions, make further comments. The goal is for the class to come up with the best possible forecast of the series shown. If you do not think there is anything worth commenting on (e.g., it's all been said before), then post a VAR (you are not graded on how perfect your VAR is) that you have estimated and comment on it.

Homework Assignment: See website

Quiz: Conditional and unconditional forecast models, sources of forecast error, transfer function models, predictive causality, optimal forecast properties, unforecastability principle, forecast encompassing

Eviews Knowledge: Running VARs
Forecasting with VARs
Calculating impulse response functions and variance decompositions

Unit #6

Material Covered: Chapter 13: Unit Roots, Stochastic Trends, ARIMA Forecasting
                                   Models, and Smoothing
                        Chapter 14: Volatility Measurement, Modeling, and Forecasting

Objectives: 1. Explain what unit roots and stochastic trends are and how they affect forecast model estimation and analysis
2. Test for unit roots and adjust data accordingly if unit roots are found
3. Estimate ARCH/GARCH models and analyze the output

Interactive Assignment: Post your preliminary work (e.g., regressions, graphs, discussion, etc.) on the final project and allow your classmates to comment on it. Comment on the work of your classmates. The idea is to help each group or person come up with the best possible forecasts for their series of interest. In addition, comment on their presentation of the material. You do not need to comment on every project, but comment on the things that strike you as important or on the things that have not been commented on. If you would like, you can repost your project after making changes suggested by your classmates during the week.

Homework Assignment: See website

Quiz: unit roots, stochastic versus deterministic trends, integrated series, ARIMA (p, d, q) models, heteroscedasticity and volatility clustering

Eviews Knowledge: Running ARCH and GARCH models
Performing unit root tests