1 Introduction

People routinely plan around the weather forecast, and are often displeased when it unfolds differently than expected. Similarly, movements in the economy matter to individuals, businesses, and governments, and these economic agents are likewise uncomfortable with unexpected changes in the economy. Thus, reliable ways to forecast economic variables are useful.

The purpose of this course is to introduce an array of methods and practices for analyzing time-series data and generating statistical forecasts. This will be accomplished through a mix of theoretical discussions and software-based applications to real-world problems. As will become clear, many familiar methods of inference are not well adapted to analyzing data with a time component, although some time-series methods do have close cross-sectional analogues.

Who should take this course? Economics 473 (Econometric Methods) has long been the flagship statistical course for the economics major; this course is intended as its companion. Any student with graduate school aspirations should take this course (as well as Economics 471 and 473). Students interested in the quantitative aspects of business decisions will benefit greatly from this material as well; indeed, an early voice of support for this course came from managers at Kimberly-Clark who were enrolled in our Master of Business Administration program. Practicing business professionals and consultants value these skills.

2 Required Books

The first book is the primary text; the second is a small but extremely useful writing guide, which is particularly well-suited to the project component of this course. Additional readings and handouts will be made available through the course website (or equivalent) as the term unfolds.

1. Business Forecasting, 6th ed., by J. Holton Wilson and Barry Keating. (Be sure to get the CD.)

2. Economical Writing, by Deirdre McCloskey.

### 3 Evaluation

Your course grade will be determined by your performance on 4 problem sets (each worth 10 points), 2 exams (each worth 20 points), and one technical report project (worth 20 points). The grade distribution is as follows:

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<thead>
<tr>
<th>Grade</th>
<th>Score Range</th>
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<tbody>
<tr>
<td>A</td>
<td>100–92</td>
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<tr>
<td>A−</td>
<td>92–90</td>
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<tr>
<td>B+</td>
<td>90–88</td>
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<td>B</td>
<td>88–82</td>
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<td>B−</td>
<td>82–80</td>
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<td>C+</td>
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<td>C</td>
<td>78–72</td>
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<td>C−</td>
<td>72–70</td>
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<td>D+</td>
<td>70–68</td>
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<td>D</td>
<td>68–60</td>
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<td>F</td>
<td>60–0</td>
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I will grade only a portion of the assigned questions on each problem set. I will grade the same questions for every student.

### 4 Course Content and Objectives

Courses on time series analysis and forecasting have a relatively standard curriculum, including, but not limited to the following:

1. Time-series data versus cross-sectional data versus panel data.
2. Features of time-series data such as seasonality and cyclicality.
3. Time-series plots.
4. De-trending and differencing.
5. Moving averages.
6. Weighted moving averages.
7. Exponential smoothing.
8. Double exponential smoothing.
9. Winter’s smoothing.
10. Time series decomposition.
13. Granger causality*.
14. Unit root tests and random walks*.
15. Co-integration*.
16. Error-correction models*.
17. Auto-regressive moving average (ARMA).
18. Auto-regressive integrated moving average (ARIMA).

Many of these topics will be couched in a forecasting setting using data from various areas of business and economics. We will also do a special topics section this semester (towards the end) on forecasting loan default.

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1. If your grade falls on a bound, you will receive the higher grade. I reserve the right to “curve” the class in your collective favor, if necessary.
2. Items denoted with an asterisk will be studied using handouts and chapters from an ancillary text, if time permits.
5 Technical Report Project

The project is worth 20 points, and requires that you form an interesting forecasting question, gather relevant data, apply appropriate methods, and write up your results in the form of a well-written technical report (more on this below).³

You can work in groups of up to three (3) people or you can do the project individually, if you prefer. Groups need to be decided and submitted to me in writing by the beginning of class on Friday 1 November and cannot be changed thereafter. So, if you are thinking of possible group members, then study with them prior to this date to be sure that you want them on your team.

The last few days of class will be allocated to presentations of your technical reports. The idea is to prepare you for a business / consulting presentation, and to give you in-depth project analysis experience that you can put on your resume and discuss during interviews.

Please adhere to the follow rules when deciding on a technical report project:

- No sports-related reports, unless you get my written prior approval. I will only consider a sports-related project if it has substantial economic content.

- No overly ambitious reports: I want you to zero in a clear, specific project that can be effectively handled with the tools developed in this course.

- No data swapping. Each group is to gather their own data; if this is violated, all students involved will be penalized.

- No data-availability fallouts. It is crucial that you form a project for which data are available.

- No computer-output core dumping. If your report is a diary of software output and every test you tried, you will receive a low score. You must learn to discern which items are worthy of the audience’s attention, and which are not.

- Do not copy and paste any computer output into your paper. If you need to report these results, you must prepare a proper table.

6 Writing a Technical Report Project

Here are some guidelines to follow when writing your technical report:

1. Executive Summary: This is a one-page summary of what you forecasted and how and why you did it. It needs to be succinct.

2. Statement of the Problem: This explains the nature of what you are trying to forecast. This section should also explain why it is important that you are performing your analysis and for whom it will be valuable.

3. Data: This describes the data you will be using to do your analysis; fully cite your (non-proprietary) data sources so that anyone can find the data if they desire. Time series plots and scatter plots are usually inserted into this section, which you can use to motivate method selection.

³McCloskey's book should greatly improve your writing, which is why it is required for the course.
4. **Methodology**: This describes the methods you use and why they are applicable to the data just described.

5. **Forecasting**: Here you pull the data and methods together to create your primary forecasts. This will include holdout analysis as well as primary forecasts. You should report the results of combination forecasting here as well. Also explore how your results might have differed had you instead used different methods than those used in your primary analysis.\(^4\)

6. **Conclusions and Summary**: Summarize your results and discuss the implications of your forecast. Add caveats (e.g., data limitations) and directions for future inquiry here as well.

7. **References**: Document prior work in the area you are researching and cite relevant data.

8. **Writing Appendix**: This should describe ten of McCloskey’s 31 writing guidelines and how you incorporated these ten items into your writing.\(^5\)

The technical report is due at the beginning of class on 13 December 2013.

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7 **Honor Code and Absences**

All honor code rules of the university are in effect for all evaluation criteria. If you miss any tests, you will need to provide me with documentation from the dean of students explaining your absence before you are eligible for a make-up exam.

\(^4\)For example, suppose you used Holt’s method for projecting a cyclical factor; how would the results have differed had you used local linear regression instead? Other examples of these types of “sensitivity checks” abound.

\(^5\)This would, of course, not be submitted with a true technical report at your place of work; however, I am requiring it for this project to help you become a better writer.