

Anderson School of Management  
UCLA

Bus 264B  
Regression Analysis with Applications to Marketing and Finance

Mr. Rossi  
Winter 2012

Syllabus

Course Information

264B is a course in the theory and application of linear regression. Special emphasis will be placed on examples from Marketing and Finance. The emphasis in this course will be on developing in-depth knowledge and a facility in regression methods rather than just a passing familiarity.

Topics include: Simple linear regression, introduction to time series, multiple regression, prediction in the multiple regression model, residual diagnostics, detection of outliers, and violations of stochastic assumptions.

Prerequisites

Statistical Concepts: Random variables, normal and t distributions, mean and variance of a linear combination of random variables, hypothesis-testing including the concepts of significance level and p-value, t-tests and confidence intervals, sampling error, and the standard error of the mean.

Data and Decisions provides a comprehensive treatment of all of these concepts. Most students have had some prior exposure to the concepts in Data and Decisions as an undergraduate. If you have not had a prior course in statistics, you should not take 264B. Even those who have had a prior course in statistics may find that they need extensive relearning of basic concepts. It is assumed that students have *command* of this material not just superficial familiarity. I include in the course notes a condensed summary of the prerequisite material. I will not review basic statistics material in 264B.

Non-Anderson students must secure permission of the instructor to enroll in 264B.

Computing

All computing will be done with R. R is a free programming environment and language for statistics and data manipulation. R is used world-wide in both academe and the private sector. We will use only a small subset of the capabilities of R in this course and this will not require extensive training. All material needed for the use of R will be developed in class and no prior knowledge of R is required.

Mathematical Preparation

All students are assumed familiar with exponential and logarithmic functions and **summation notation**.

Homework and Tests

A midterm (24%), final (44%), and problem sets (32%) will constitute the course evaluation.

The homework will be collected on a weekly basis. A total of eight homeworks (@ 4pts each) will be assigned, collected and graded. Homework will be graded as check (complete: 4 pts), check minus (incomplete: 3 pts), or 0 (not turned in). Complete means that all problems have been worked and are substantially correct. **Homework missing any problem will be graded check minus.**

Due Dates for HW are as follows:

Assignment	Week Due	Pts
HW 1	2	4
HW 2	3	4
HW 3	4	4
HW 4	5	4
Study for Midterm	6	
HW 5	7	4
HW 6	8	4
HW 7	9	4
HW 8	10	4

The homework is design to reinforce the class concepts, teach actual data analysis using R, and prepare for the exams.

Homework is to be done individually. You may ask the instructor clarifying questions regarding the homework.

**Late HW Policy:** You will be allowed only one late hw per quarter (this only applies to HW #1-8). Late is defined as turned in after the solutions are posted to the web. If you submit more than one late hw, the hw will be returned to you ungraded and you will receive zero credit for it.

**Please do not submit unedited output.** CUT and PASTE the relevant portions of the output into your homework document. Simply copy graphs using copy from graph menu.

If a question on the homework requires you to do some analysis in Minitab, please provide the relevant portions of the analysis as part of your homework.

Exam schedule:

**Midterm**

264B-01: Thursday 2/16 8:30-9:40am,

264B-02; Wednesday 2/15, 7:10-8:40pm

(exam will last 1hr 30 minutes, followed by a short lecture)

**Final**

264B-01: Thursday 3/22, 11:30am-1:30pm in B301 (note change of room!!!!)

264B-02: Wednesday 3/21, 7:10-9:10pm in C315.

(final is only two hours long)

Exam Review Sessions:

For Midterm: Saturday 2/11, 11am-12pm, room TBA

For Final: Saturday 3/10, 11am-12pm, room TBA

If you plan on attending the review sessions, be prepared to ask questions! Do not expect a planned lecture!

Exam attendance:

You must take the exam with your section unless you secure *prior* written permission from me. It is expected that students will complete all exams for the course. **I will only entertain requests for rescheduling the exam in cases of extreme medical or personal emergency.** This *does not* include job interviews, weddings, vacations or class trips. Any request must be made *in advance*.

Having one or more other exams on the same day is NOT a legitimate reason for exam rescheduling. Similarly, the fact that a case assignment or course project is due on the exam date is NOT legitimate either. Plan ahead to manage your time.

Exam Format:

All exams are closed-book/closed-notes. You may bring one 8 1/2" x 11" cheat sheet (you may use both sides). Note you may not bring your midterm cheat sheet to the final exam. Only one cheat sheet per exam.

**Please bring a calculator to all exams. Your calculator must be able to compute natural logs and exponentiate.**

Requests for Regrade:

All requests for regrading of exams must be made in writing and state clearly the basis of the request.

All requests for regrades must be made within 14 days of the date of the exam.

Clerical errors will be corrected at no risk to the student. All other regrading requests will result in regrading of the entire exam. Downward as well as upward revisions of a grade are possible.

The following **are not** legitimate reasons for a regrade:

1. "I understand this material. I was just flustered that nite"
2. "What I wrote is correct (even though it answers a different question)"
3. "If I get an A, I will get on the Dean's list"
4. "I'm just as smart as X, who got an A"
5. "I had statistics as an undergrad and I always did well"
6. "I am an [ fill-in engineer, scientist, phd in astrophysics] and I should do well"

## Class Attendance

Class attendance is vital to obtain a thorough understanding of the material. **Once you enter the classroom, you are expected to stay until the class ends.**

## Class Handouts

You are responsible for bringing the relevant section of the lecture notes to **every** lecture. All course materials are available on the course web site:

<http://www.perossi.org/home/class-materials-1/b264b-2>

## Office Hours/Email/Telephone

### **In person:**

B4.12, please email for an appointment.

### **By E-mail:**

I regularly read my email. This is the fastest and most reliable way of making contact with me.

perossichi@gmail.com

**NOTE: read the syllabus and assignments before asking procedural or logistical questions. Questions about the course *content* are always welcome. Questions because you are not willing to read the syllabus and assignments are not.**

## Class Materials

All course materials are available on the web. Students are responsible for printing their own copies of course materials.

There are no required texts for the class. My classnotes are entirely self-contained. However, there are those who like to consult a text for another point of view. I recommend two texts:

Dielman, *Applied Regression Analysis*, 4<sup>th</sup> Edition. A good text that covers many of the topics we consider.

Dalgaard, *Introductory Statistics with R*. Nice intro to stat and R.

## Course Outline and Readings

### 0. Key Statistical Concepts

- A. Random Sample concept
- B. Normal Distribution
- C. T-tests on Means
- D. Covariance and Correlation
- E. Linear Combinations of Random Variables appendix a: mathematical prerequisites

### I. Introduction to Regression

- A. Conditional Forecasting
- B. Hedonic Pricing and Flat Panel TVs
- C. Linear Prediction and Fitting
- D. Least Squares
- E. Intuition behind Least Squares
- F. Relationship between  $b$  and  $r$
- G. Decomposing the Variance of  $Y$  and  $R^2$

Examples: Hedonic Pricing, Real Estate Valuation

### II. The Simple Linear Regression Model

- A. Prediction and the Modeling Goal
- B. The Simple Linear Regression Model
- C. Prediction Intervals with the True Model
- D. Summary of the Simple Linear Regression Model
- E. Three Key Characteristics of the SLR Model
- F. Estimation of  $\sigma^2$
- H. Conditional Distributions vs. Marginal Distributions
- G. Another conditional distribution

Examples: Hedonic Pricing and evaluating Mutual Funds

### III. Estimation and Testing in the Simple Linear Regression Model

- A. Estimation in the SLRM
- B. Sampling Distribution of  $b_1$
- C. Understanding Standard Errors
- D. Confidence Intervals
- E. Log-Log Price Elasticity Regressions
- F. Hypothesis Testing and p-values
- G. Market Model and Hypothesis-testing
- H. p values

Examples: price elasticity regressions, market model

### IV. Prediction and Diagnostics

- A. Forecasting

- B. Why Regression Diagnostics?
- C. Residuals and Their Plots
- D. Putting It Altogether : predicting shock absorber performance

Examples: anscomb data and shock absorber data

#### V. The Multiple Regression Model

- A. The Multiple Regression Model
- B. The Data and Least Squares
- C. Inference and F-tests
- D. Prediction
- E. Multiple Regression Explained
- F. More on the Interpretation of MR Coefficients

Examples: sales and pricing data, relationship across countries in stock market prices

#### VI. Introduction to Time Series

- A. Introduction to Dependent Observations
- B. Checking for Independence
- C. Autocorrelation
- D. The AR(1) Model
- E. Random Walks
- F. Trends and Random Walks
- G. Stock Prices and market efficiency
- H. Predicting the Equity Premium

Examples: stock prices, random walks, returns, and market efficiency

#### VII. MR Topics: Multicollinearity, Leverage, Non-linearity

- A. MR Standard Errors
- B. Multicollinearity
- C. Standardized Residuals and Leverage
- D. Outliers
- E. Influence
- F. Nonlinearity
- G. Dummy Variables
- H. Heteroskedasticity
- I. More on Log-Transforms
- J. A Strategy for Building Regressions

Examples: log-log elasticity regressions,

#### VIII. Advanced Topics Illustrated by Example

- A. Omitted Variables and Fixed Effects: Elasticity analysis revisited
- B. Experimental Design: New Product Testing
- C. Model Selection: The Equity Premium