School of Management Syllabi                                           NJIT Syllabi

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Fall 2019

# FIN 310-001: Data-Drive Financial Modeling

Jim Shi

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# FIN 310 – Data-Driven Financial Modeling

Fall 2019

## Course Syllabus

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Course Code: FIN 310, Sec: 001, Credits: 3.00

Instructor: Dr. Jim Shi
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Note: e-mail is the best form of contact;
Please add *FIN310* as a part of the subject line
Office: 4018 Central Avenue Building (CAB), a.k.a. the library building
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Fax: 973-596-3074
Homepage: https://web.njit.edu/~jshi/

Class Venue:

| Section Number | Classroom | Meeting Time | Weekday |
|---|---|---|---|
| 001 | **Business Analytics Lab (CAB1006)** | 11:30am ~2:20pm | Tuesday |

**Business Analytics Lab** is located on first floor of the CAB, a.k.a. the Library Building. It is next to the main entrance of the library.

Class Website: Canvas.njit.edu (select FIN310) for course materials
Office Hour: by appointment (it is better to send an email before dropping by, preferable 3-4pm Tuesday).

## Prerequisites

MGMT 116 Computer Applications in Business with Excel Lab.
MGMT 216: Business Statistics;
MGMT 316: Business Research Methods;
FIN 218: Financial Markets and Institutions;
FIN 315: Foundations of Corporate Finance.

## Textbook (Optional):

Text 1:
[1] "Financial Modeling", Simon Benninga, ISBN-13: 978-0262027281; ISBN-10: 0262027283, MIT Press, 4th Edition, (April 18, 2014).

## Recommended Reference

[2] "Introduction to Financial Models for Management and Planning", James R. Morris and John P. Daley Published by Chapman and Hall/CRC; 2 edition (May 15, 2017).

[3] "Spreadsheet Modeling and Applications", by Albright and Winston, Thomson/Duxbury Press 2005.

[4] "Fundamentals of Futures and Options Markets", (selected chapters) by John C. Hull, 9th Edition, Pearson, 2016.

## Software (Required):

**Microsoft Excel**   Available as part of Microsoft Office 2013, or 2016 (Windows OS); Office: Mac 2011 or 2016 (Mac OS);
Free download at
http://ist.njit.edu/software/download.php.
Please be aware of the differences among versions in features and layout. We shall only use Excel 2013 for Windows OS. If needed, please take the advantage of on-campus computers.

## Course Overview and Description

In today's information era, Data are the DNA of financial service sector and managers increasingly rely on data and financial models to make financial decisions. Financial modeling driven by financial data is of critical importance to asset allocation, pricing, trading strategies, and risk management. By introducing basic and innovative financial modeling techniques, this course equips students with new analytic and modeling tools to tackle rapidly changing and dynamic financial markets.  In particular, this course delivers modelling frameworks such as regression analysis, forecasting, Monte-Carlo simulation, optimization, and binomial trees; and it illustrates how to apply these frameworks in financial contexts such as portfolio management, term-structure estimation, capital budgeting, risk measurement, risk analysis in discounted cash flow models, and pricing of European, American, exotic, and real options. The modelling tools will be illustrated by applying them to a variety of real-world financial data that can be obtained directly from Bloomberg Terminals and others.

## Course Learning Outcomes

Upon completion of this course students will be able to:

1) Each student will be able to develop a variety of financial models with Excel Spreadsheet;

2) Students will gain mastery of useful skills to process financial data;

3) Student can leverage spreadsheet models to make efficient data-driven financial decisions;

4) Students will develop a practical understanding of the financial theory underlying financial models;

5) Students will use financial models and theory to address a variety of financial planning and pricing problems;

6) Students will communicate their findings from financial models clearly and concisely.

**Attendance/Class Participation/Homework:**

Your class participation grade will be based on attendance only. All homework assignments (if any) will be reviewed in class. You are highly expected to attend classes. Class attendance will be taken in the beginning of class. If you do miss a class, you are responsible for obtaining notes and remaining current. It is not possible to repeat lectures for students missing class. One "free" absence is allowed. There are no "excused absences." Additional absences will hurt your final grade. It is clear that the final grade will be an **"F" if you missed FOUR or more attendances**.

Late students are responsible for signing the class roll before leaving. Otherwise, you will be considered absent. Excessively late students and students leaving early will be penalized. If you arrive late, it is *your* responsibility to remember to sign the roll before you leave.

*All pagers, cell phones should be turned off or muted during class.*

*All pagers, cell phones and smart devices (e.g., Apple Watch) should be turned off during tests.*

*Lab computer is for lecture purpose only; checking emails or other internet actions are firmly prohibited. This will be counted as a part of class attendance.*

**Grading Policy:**

| Grading: | | Weight |
|---|---|---|
| Competency Exercise (Excel Spreadsheet Tutorial) - Required! | | 0% |
| Tests | 3 Tests  (10 pts. each) | 30% |
| Projects | 2 Projects (15 pts. each) | 30% |
| Exercises | 6 exercises, 5pts for each (online submission) | 30% |
| Attendance | | 10% |
| **Sum** | | **100%** |

Please note that NJIT recommended grading scheme is as follows:

| | |
|---|---|
| **A** | for Superior performance (90% or higher) |
| **B+** | for excellent performance (87 to 89.99%) |
| **B** | for very good performance (82 to 86.99%) |
| **C+** | for acceptable performance (76 to 81.99%) |
| **C** | for fair performance (70 to 75.99%) |
| **D** | for minimal performance (65 to 69.99%) |
| **F** | Otherwise. |

Professional and personal circumstances that preclude you from performing at satisfactory levels will not be considered in the determination of the course grade. The effect of your grade on overall GPA, eligibility for graduation, loss of scholarship, loss of a United States resident card, placement on academic probation, etc., are *not* considered in the determination of your grade.  <u>There are no extra credit assignments. Individual requests for alternative ways to improve your course grade will not be considered.</u>

**<u>There will be no makeup exam, nor extra work for extra credit</u>**.  So please make all your effort to attend the scheduled tests.  Your final grade is not subject to negotiation. After all the lectures, **<u>please do not ask me for extra work for extra credit</u>**.

**Examinations:**
Tests will be administered in class according to the attached schedule. Tests may be a mixture of multiple choice and true/false.  Class tests and the common final will test both your understanding of concepts and problem solving ability, and will also include questions about the use of Excel to solve problems in this course.

For in-class tests, you will need to bring a basic calculator (with a square root button!) and *one* 8.5"x11" page of notes (two-sided, must be *hand written* by yourself). Smart phone or smart device (e.g., Apple Watch) is firmly restricted to the test.  Students are required to provide their own pencils and scratch paper.  All material needed for tests will be covered in class.  All students are required to take the tests on time.
No make-up test will be provided.

**Individual Student Projects:**
Individual class projects will be discussed in class.  These are **not** group projects!
Projects are to be submitted on paper by each student by the designated date, including data output and formulas.  No diskettes will be accepted, as they are easily misplaced and damaged.  *Late projects will be penalized at a rate of 5% per calendar day.*  In addition, once the deadline has passed, no further feedback will be given.  Use the "fit to one page" option to print your output on 8.5x11" sheets.  No report covers, please!  Students submitting spreadsheets that are not unique will receive **a zero grade** for the project!   You may discuss projects with your classmates, but the work you turn in **must be your own**!

**PowerPoint Slides:**
Copies of the PowerPoint slides for this course can be found on the class website (see page one of this syllabus).  To minimize note taking, you should print the slides for each class in advance and bring them to class.

**E-mail communication**
Students are to use their NJIT e-mail (ucid@njit.edu) in communicating with the instructor.
It is also convenient to communicate at moodle platform.

## Computer Requirement and Access to the Internet

NJIT requires all students to have access to a computer at their place of residence. Details as to this requirement may be found on the college's website on the page describing NJIT's Undergraduate Student Computer Requirement.

Access to the Internet is required for this course. NJIT provides on campus access to the Internet to all students. Details as how to access the Internet as well as other resources at NJIT may be found in the Student Quick Start Guide.

## Deadlines/Late Work/Make-ups

Specific policies concerning the acceptance of late work and make-ups are discussed in the sections covering course requirements. In general, work will not be accepted late and make-ups will not be given. Exceptions will be made when extraordinary circumstances were responsible for work not being completed on time. Students may need to contact the Dean of Students' office and have it determine that the reasons given for not doing the work on time are valid.

## Incompletes

Incompletes will be given only to students who cannot finish the course on time due to major reasons outside of their control (e.g. illness, family tragedy, military service). Students may need to contact the Dean of Students' office and have it determine that the reasons given for not doing the work on time are valid.

## Students with disabilities

Students with disabilities needing accommodations of any nature so as to have a fair opportunity to perform in the class need to contact the counseling center. Staff at the counseling center will determine what constitutes a reasonable accommodation and inform the instructor of what it is.

## Honor Code

Plagiarism in any form is not acceptable. While discussion with classmates regarding homework and projects is encouraged, all work submitted must be your own. Evidence of plagiarism on an assignment/exam will be reported to the dean's office of students and result in a failing grade for that assignment/exam.
You are required to follow NJIT's honor code, which can be found at
http://www.njit.edu/doss/policies/honorcode/.

## Some Weblinks for Reference

| | |
|---|---|
| Bloomberg | www.bloomberg.com/markets |
| Google Finance - | www.google.com/finance |
| Yahoo Finance | http://finance.yahoo.com/ |
| Investopedia | https://www.investopedia.com/university/ |
| Kitco | http://www.kitco.com/ |
| U.S. SEC | https://www.sec.gov/edgar.shtml |
| XE - Foreign Exchange | http://www.xe.com/. |

**Course Structure**

A famous old Chinese saying goes

"***I hear, I forget. I see, I remember. I do, I learn***".

The structure of the course "Data-Driven Financial Modelling" tries to capture the wisdom of this proverb. Students who take this course emphasize as a strength that the combined course structure: lecture + example + projects, which facilitates the learning of complex financial models.

The software used in the course is Microsoft Excel, with the add-ins Solver for optimization and @Risk for simulation, which can be downloaded from the course website.

We will discuss spreadsheet modelling best practices, and review useful spreadsheet features such as data tables, database operations, pivot tables and charts, the data analysis tool pack, and other statistical built-in functions. In addition, the use of macros to automate spreadsheet tasks will be illustrated.

The table below provides a summary of the financial contexts, modelling frameworks, and spreadsheet features covered.

| Financial Context | Modelling Framework | Spreadsheet Functionality |
| --- | --- | --- |
| o Cash-flow analysis<br><br>o Mean-variance portfolio selection and analysis<br><br>o Bond portfolio management<br><br>o Term structure estimation<br><br>o Capital budgeting<br><br>o Risk measurement<br><br>o Discounted cash-flow risk analysis<br><br>o European and American Option valuation and pricing<br><br>o Exotic option valuation<br><br>o Real option valuation | o Regression analysis<br><br>o Descriptive Statistics<br><br>o Monte-Carlo simulation<br><br>o Linear, integer, and nonlinear optimization<br><br>o Binomial decision trees<br><br>o Forecasting | o Net present value, Goal seek<br><br>o Sensitivity analysis (what-if) with data tables<br><br>o Creating tornado diagrams<br><br>o Database operations<br><br>o Pivot tables and charts<br><br>o Matrix operations<br><br>o Regression analysis<br><br>o Recording and editing macros via VBA |

**Course Outline**
This outline provides the tentative content for the course. Minor adjustments (if needed) to this outline may occur since the pace of a course is difficult to predict. All readings are from the text except where otherwise noted.

# Week 01: Corporate Financial Statements

➢ **Spreadsheet skills:**
Organizing and creating spreadsheets; entering and formatting data values; entering expressions for calculating values; linking worksheets; splitting screens to facilitate working between several worksheets.

➢ **Financial management skills:**
Understanding the three key financial statements (i.e., a company's income statement, balance sheet, and cash flow statement) and the relationships between the various items on them.

# Week 02: Analysis of Financial Statements

➢ **Spreadsheet skills:**
Using logical IF statements; using conditional formatting to call attention to conditions that need correcting; pasting an Excel document into a Word document.

➢ **Financial management skills:**
Analyzing the year-to-year changes in financial statements and various financial ratios; performing vertical analysis of financial statements; using financial ratios to benchmark a company's performance against competitors; inserting spreadsheet results into company reports.

# Week 03: Forecasting Annual Revenues

➢ **Spreadsheet skills:**
Creating, validating, and using linear, quadratic, cubic, and exponential regression models to fit the trends of historical data; creating various types of charts (e.g., scatter diagrams, forecast charts, error patterns, and downside riskcurves); estimating the accuracy of forecasts; expressing forecast accuracy in terms of confidence limits and downside risk curves.

➢ **Financial management skills:**
Making forecasts; recognizing the difference between valid and invalid forecasting models; handling the risks inherent in forecasts; adjusting regression models for changes in trends.

# Week 04: Forecasting Financial Statements

➢ **Spreadsheet skills:**
Using forecasts of revenues to forecast financial statements; using Excel's Scenario Manager to do sensitivity analysis.

➢ **Financial management skills:**
Forecasting financial statements and determining what happens if

conditions change.

## Week 05: Forecasting Seasonal Revenues
➢ **Spreadsheet skills:**
Creating a seasonally-adjusted forecasting model by joining seasonal adjustments to an annual trend line or a moving average trend line; using error feedback to correct a model so that the average error is zero; using period values to update annual forecasts and revise the model.

➢ **Financial management skills:**
Recognize seasonal variations in cash flows and demonstrate their importance to a firm's financial, marketing, and operations management.

## Week 06: The Time Value of Money
➢ **Spreadsheet skills:**
Using Excel's financial functions for calculating the present value of a future amount, the future value of a present amount, the net present value of a series of cash flows, periodic payments for mortgages and loans, etc.; linking an Excel worksheet to a Word document.

➢ **Financial management skills:**
Understand the concept of the time value of money and apply it to various types of financial decisions (e.g., creating sinking funds).

## Week 07: Cash Budgeting
➢ **Spreadsheet skills:**
Organizing a spreadsheet into modules for different parts of a company and linking results; using a one-variable input table for sensitivity analysis to evaluate alternate operating tactics.

➢ **Financial management skills:**
Understanding the role of a cash budget in a company's marketing, production, and financial operations; examining the impacts of changing conditions on cash flows: forecasting the short-term borrowing and lending a CFO must plan for.

## Week 08: Cost of Capital
➢ **Spreadsheet skills:**
Calculating the weighted average cost of capital (WACC); using Excel's Goal Seek and Solver tools to find the value of an independent variable (e.g., return on equity) to satisfy a related goal (e.g., a specified WACC); evaluating the WACC for different amounts of capital raised and creating charts to display the results.

➢ **Financial management skills:**
Identify sources and costs of capital and understand how to use them to compute a firm's WACC; distinguish between WACC based on book value and WACC based on market value; understand what's meant by flotation costs and how to include them in a firm's WACC.

## Week 09: Profit, Break Even, and Leverage
➢ **Spreadsheet skills:**

Calculating profits from a firm's cash flows; using Excel's Solver tool to determine the sales volume needed to break even; evaluating a firm's operating, financial, and combined leverages.

➢ **Financial management skills:**
Be able to explain what's meant by profit, break-even, and leverage, how to measure them, and why they're important.

## Week 10: Capital Budgeting: The Basics
➢ **Spreadsheet skills:**
Organizing spreadsheets to move from sales revenues to after-tax cash flows; using Excel's financial functions to calculate depreciation schedules; calculating financial measures of success, such as net present value and internal rate of return; using nested IF statements to determine the discounted years to break even; creating two-variable input tables for sensitivity analysis; using Excel's Solver tool to determine changes that must be made to achieve specified goals, such as a specified net present value or discounted years to break even.

➢ **Financial management skills:**
Review taxes and depreciation; understand the inputs and outputs of capital budgeting; understand the various types of depreciation; distinguish between income taxes on regular income and capital gain and how they're calculated; apply appropriate financial criteria to evaluate investments in capital assets.

## Week 11: Applications of Capital Budgeting
➢ **Spreadsheet skills:**
Creating spreadsheets that evaluate the financial payments from various types of capital investments; using one- and two-variable input tables to analyze the sensitivity of financial payoffs to changes in conditions.

➢ **Financial management skills:**
Evaluate financial payoffs from different types of capital investments, such as investing in new facilities, investing in non-residential real estate, replacing equipment; improving production methods, and determining whether to lease or buy equipment.

## Week 12: Capital Budgeting: Risk Analysis with Scenarios
➢ **Spreadsheet skills:**
Using Excel's Scenario Manager to analyze the effects of various combinations of conditions (e.g., best-on-best, most probable, and worst-on-worst) on future payoffs.

➢ **Financial management skills:**
Using probabilities to define risks.

## Week 13: Capital Budgeting: Risk Analysis with Monte Carlo Simulation
➢ **Spreadsheet skills:**
Using Excel's tools for Monte Carlo simulation; using Excel's random number generator to generate random numbers that follow different probability distributions (e.g., uniform, normal, and triangular distributions) and use the results.

> ➤ **Financial management skills:**
Be able to explain the concept of probabilities and their use to define risks; be able to create downside risk charts and explain their use to show the probabilities for reaching specified financial goals.

## Week 14: Valuation of Common Stocks and Bonds

> ➤ **Spreadsheet skills:**
Determining the value of shares of common stocks from their expected future cash flows and an investor's expected rate of return; performing sensitivity and risk analysis related to the value of stocks. Determining the value of bonds from their fixed future cash flows and an investor's expected rate of return; performing sensitivity and risk analysis related to the value of bonds; evaluate the effect of call date on a bond's value.

> ➤ **Financial management skills:**
Be able to define value, as related to stocks, and explain the methods used to calculate it. Be able to define value, as related to bonds, and explain the methods used to calculate it.

## Tentative Schedule
### Deviations may be necessary
### Some supplementary homework assignments will be added as the course progresses

| Week | Topics | Recommended Reading | Homework Exercises | Note |
|------|--------|---------------------|--------------------|------|
| 1 | Introduction Excel Spreadsheet | Syllabus Lecture 0 | Excel Tutorial | Self warm-up with Excel |
| 2 | Lecture 1 | | | |
| 3 | Lecture 2 | Ch. 1 | HW I Due | Sep. 13th, last day to Add/Drop |
| 4 | Lecture 3 | Ch. 2 | | |
| 5 | Lecture 4 | Ch. 3 | HW 2 Due | |
| 6 | Test I (multiple Choice Questions) | Lectures 1-3 | | No Lecture |
| 7 | Lecture 5 | Ch. 4, | | |
| 8 | Lecture 6 | Ch. 4, 5, 6 | HW 3 Due | Nov. 11th, the Last Day to Withdraw |
| 9 | Lecture 7 | Ch. 7 | | Project I Due |
| 10 | Test II (multiple Choice Questions) | Lectures 4-7 | | No Lecture |
| 11 | Lecture 8 | Ch. 8, 9 | HW 4 Due | |
| 12 | Lecture 10 | Ch. 14 | | Project II Due |
| 13 | Lecture 10 | | | |
| 14 | Test III | | | No Lecture<br><br>Dec. 11th, last day of Fall<br><br>Dec. 22nd Grade Due |