

Preface

The title of this book is called *Financial Modeling using Excel --in an R-assisted learning environment*. The phrase “R-assisted” distinguishes this book from other books applying Excel to Financial Modeling. There are several reasons why this feature is critical. First, R is free software, downloadable at <http://r-project.org>. Second, readers are not required to learn R. In short, we try to reap the benefits generated by R without requiring readers spending any time on R. In addition, a potential instructor who adopts this book as his/her text book don’t need to know R as well. All that readers, students or instructors need to remember is just one R code, shown below.

```
> source("http://canisius.edu/~yany/fm.R")
```

where “>” is the R prompt. In the first chapter, we explain the meaning of this one-line code. Below are the main features of our brand new approach to apply Excel to Financial Modeling at various business schools.

Starting from scratch

From this book, a reader learns basic Excel skills and apply them to finance. It is a beginner’s book. In other words, it does not require readers to have any prior Excel knowledge or skills. On the other hand, in terms of finance, readers should possess basic finance knowledge.

Using R without learning it

Readers are not required to learn R and this book will not teach R. In Chapter 16: R Basics, some preliminary concepts are introduced. Even for this 8-page long chapter, it is optional!

Using tons of public data

This book uses a huge amount of publicly available data for economics, finance and accounting. After typing `.getdata`, the following menu would pop up.

```

> .getdata
function() {
"
*-----*
* .getdata *
*-----*
* Economics/Accounting Finance *
*-----*
* .show_usGDPAnnual .showff3Monthly .show_ct1day *
* .show_usGDPquarterly .showff3Daily .show_cq1day *
* .show_usUnemployRate .showffc4Monthly .show_ct3month *
* .show_usDebt_annual .showffc4Daily .copy2Excel *
* .show_usCPI_annual .showff5Monthly .show_cq3month *
* .show_usCPI_monthly .showff5Daily .show_sp500monthly *
* .show_euroDollar_lm .showAaaYieldDaily .getCIKgivenTicker *
* .show_dollarIndexMonthly .showBaaYieldMonthly .show_sp500daily *
* .show_goldPrice .showBaaYieldDaily .show_bondSpread *
* .show_fedFundRate .showTradingDaysDaily .show_ibmMonthly *
* .show_vix .showTradingDaysMonthly .show_wmtMonthly *
* .getBS20 *
* .getIS20 .getDailyYanWeb *
* .getCF20 .getMonthlyYanWeb *
* .getBSannual .copy2Excel *
* .getISannual .saveYan *
* .getCFannual .saveFinStatement *
*-----*
* >.show_usGDPAnnual # find the usage of this function *
* >.getdata # back to this menu *
* >.fm # back to the main menu *
*-----*

```

All functions are self-explanatory. After typing the name of a function, we see its objective, formula used (if any), the meaning of an input/inputs and a few examples. For example, the following image is the result of typing `.show_usGDPannual`.

```

> .show_usGDPAnnual
function(n=2){
"Objective : show US annual GDP value
  n   : number of observations (default is 2)
        n > 0 for the first n obs
        n < 0 for the last  n obs
        n = 0 for all obs

  source:  http://www.usgovernmentspending.com/download_raw
  Unit   : billion

```

```

Example 1:> .show_usGDPAnnual()
      DATE GDP_CURRENT GDP2009DOLLAR
1 1929      104.6      1056.6
2 1930       92.2       966.7

```

```

Example 2:> .show_usGDPAnnual(-3)
      DATE GDP_CURRENT GDP2009DOLLAR
85 2013      16663.2      15583.3
86 2014      17348.1      15961.7
87 2015      17947.0      16348.9

```

```

Example 3:> x=.show_usGDPAnnual(0)
      Launch Excel and paste

```

An efficient way to retrieve data

How efficient is our method to retrieve data? 3 second for each time series! For example, to download quarterly GDP, monthly CPI, historical daily IBM's price data, daily S&P500 index data and IBM's latest 3 years' balance-sheets, income statements and daily Fama-French factors, it should take less than 2 minute. Below is an example of retrieving monthly Fama-French 3 factors and saving them for further analysis by using Excel.

```

> x=.showff3Monthly(0)
      Launch Excel and paste

```

In total, we have just two lines of commands. The first command line would retrieve all observations and assign them to a variable called `x`. The second line saves `x` to an external file. The last line serves as a reminder of where our data file is located.

High frequency trading data

This may be a perfect example to show how to use data. To our best knowledge, no instructors have ever shown high-frequency data to their undergraduates. When one of the authors was a doctoral student at McGill, he heard professors talking about high-frequency data and read a few market Microstructure related papers. However, nobody showed doctoral students high-frequency data. Only many years after his graduation, he could access the TAQ (NYSE Trade and Quote) database. Using our methodology, viewing and retrieving several small sets of high-frequency trading data are trivial, shown below.

```
> .show_ct1day
function(n=2){
" Objective: show CT data
  n : n > 0 for the first n obs (default is 2)
     n < 0 for the last  n obs
     n = 0 for all observations

Example 1: > .show_ct1day()
      SYMBOL      DATE      TIME PRICE  SIZ g127 COND TSEQ EX
1      AC 19910131  9:35:31 17.25  600   40 2068  N
2      AC 19910131  9:42:45 17.25 2700   40 2070  N

Example 2: > .show_ct1day(-3)
      SYMBOL      DATE      TIME PRICE  SIZ g127 COND TSEQ EX
14813  ZNT 19910131 13:16:59 12.5 10000   0      237889  N
14814  ZNT 19910131 14:51:52 12.5   100   0      237891  N
14815  ZNT 19910131 14:52:27 12.5  3600   0      Z      0      T

Example 3:> x=.show_ct1day(0)
Launch Excel and paste
```

The 1st example above shows the first 2 lines of CT (Consolidated Trade). The 2nd example shows the first 3 lines of CQ (Consolidated Quote), while the last example shows the last 5 lines of CQ. The latter retrieves all observations of this day's CQ data and saves them to an external CSV file for further analysis using Excel (the first several lines from the output file are shown below).

	A	B	C	D	E	F	G	H	I	J
1	SYMBOL	DATE	TIME	BID	OFR	BIDSIZ	OFRSIZ	MODE	QSEQ	EX
2	AC	19901101	9:30:44	12.875	13.125	32	5	10	1586	N
3	AC	19901101	9:30:47	12.75	13.25	1	1	12	0	M
4	AC	19901101	9:30:51	12.75	13.25	1	1	12	0	B
5	AC	19901101	9:30:52	12.75	13.25	1	1	12	0	X
6	AC	19901101	10:40:13	12.75	13.125	2	2	12	0	M
7	AC	19901101	13:36:15	12.875	13	32	10	12	1593	N
8	AC	19901101	13:36:17	12.75	13.125	1	1	12	0	B
9	AC	19901101	13:36:21	12.75	13.125	1	1	12	0	X
10	AC	19901101	13:40:03	12.875	13	32	8	12	1594	N
11	AC	19901101	13:46:17	12.875	13	24	8	12	1596	N
12	AC	19901101	13:46:20	12.875	13	24	5	12	1597	N
13	AC	19901101	13:55:22	12.875	13.125	24	5	12	1599	N
14	AC	19901101	13:55:24	12.75	13.25	1	1	12	0	B

Again, assigning all observations to a variable and saving it only takes a few seconds. With this data set, students could calculate spread and relative spread. For advanced topics, students could learn how to merge CT with CQ and estimate who would initiate a trade by applying Lee and Ready (1991) methodology.

In class exercises

The best way to learn Excel is via hands-on. For this reason, we have developed about 60 in-class-exercises. For each class, students will do at least 2 of them, shown by the list below:

```

'> .ice
function(i) {
"
  1 Description
  -----
  1 =A1 What does it mean?
  2 Type =is to see all related functions
  3 N minus 1
  4 FVIF (Present value interest factor) table
  5 Conditional formatting
  6 Percentage vs. log returns, solver()
  7 Ctrl-a, Ctrl-b, Ctrl-d (record your macros)
  8 Usages of pv(), fv(), rate(), etc.
  9 Date related functions
  10 All functions related to Date & time
  11 A true NPV function: NPVyan
  12 SEC filings
  13 CLK-ticker mapping
  14 VBA 4 geometric mean
  15 VBA for durationYan
  16 VBA for LPSD
  17 Is IBM's daily mean return zero?
  18 Test for equal-mean and equal-variance
  19 Benford law example
  20 IMB daily returns follow a normal distribution?
  21 Excel rate() vs. yield() function
  22 Usage of logRet
  23 All combinations with Ctrl
  24 Generate a table/choose a name from a list
  25 Return the 'left column' using Vlookup() function
  26 Simple Event study (just one)
  27 named range and named cell
  28 logic: IF, AND, OR, NOT
  29 simple graph (x vs. y)
  30 pv of growing annuity without a formula
  31 VBA for present value of a growing annuity
  32 enter T1, T2, to T500000 (fill -> Series ->...)
  33 Slot machine (1)
  34 index() function
  35 index() and match() functions
  36 Randomly choose a cell from a range
  37 Find one C from many O's
  38 which party indicator
  39 Vlookup() range lookup function
  40 tests of equal means and equal variances

  1 Description
  -----
  41 Black-Scholes-Merton call explanation
  42 Black-Scholes-Merton call pricing hands-on
  43 VBA for Black-Scholes-Merton call option
  44 VBA for Black-Scholes-Merton put option
  45 Generate random numbers
  46 Using rand() function to estimate pi
  47 String manipulation
  48 Simple macro
  49 Simple macro (2)
  50 hit Ctrl-a to call a macro
  51 VBA =todayPrice('ibm')
  52 Slot machine (2) linking with pictures
  53 normal distribution
  54 help, print instruction and var-corr matrix
  55 Simulate stock price from t to t+1
  56 Simulate terminal stock price sT
  57 pricing a call (put) by using simulation
  58 Asian options
  59 Powerball Simulation
  60 VaR (assume a normal distribution)
  61 VBA for variance-covariance matrix
  62 correlated random numbers and efficient frontier
  63 Benford law (2), IBM last three year balance sheets
  64 January effect
  65 Excel matrix manipulations
  66 spread estimation using high-frequency data
  67 Auto fill
  68 Benford law (1)
  69 How many eggs do we have?
  70 T-value and F-value
  71 draw a term-structure of interest rate
  72 Converting daily returns to weekly/10-day/monthly/annual one$
  73 vlookup()
  74 When developer is not available
  75 showFormula function
  76 generate random numbers with a seed
  77 find out all functions
  78 Do Walmart daily returns follow a normal distribution?

Example 1:>.ice # show all exercises
Example 2:>.ice(1) # see the first one

```

A free financial calculator

A financial calculator, written in R, is available. For each function, we could see its formula, the input definitions and a few examples. In addition, we have generated several functions not available on Excel, such as `.pvGrowingAnnuity()` and `.rateYan()`. After typing `.fincal`, the following menu would pop up.

```
*-----*
* Financial calculator 6/2/18, yany@canisius.edu *
*-----*
* .pv_f          .npv_f          *
* .pvPerpetuity .pmtExcel         *
* .pvPerpetuityDue .nperExcel         *
* .pvAnnuity      .rateYan          *
* .pvAnnuityDue   .duration           *
* .pvGrowingAnnuity .modifiedDuration *
* .bondPrice      *
* .fv_f           *
* .fvAnnuity      *
*-----*
* >.pv_f          # see the usage          *
* >.fincal        # back to this menu   *
* >.fm            # back to the main menu *
*-----*
```

After typing `.rateYan`, we would see the following image:

```
> .rateYan
function(APR,method){
"Objective : from one APR to another APR and effective rate
  APR : value of the given Annual Percentage Rate
  method : Converting method, e.g., 's2a', 's2q', 's2c'
           a for annual
           s for semi-annual
           q for quarterly
           m for monthly
           d for daily
           c for continuously

Example 1: > .rateYan(0.1,'s2a')
           Two rates
           effective annual rate 0.1025
           APR                   0.1025

Example 2: > .rateYan(0.1,'s2q')
           Two rates
           effective quarterly rate 0.02469508
           APR                   0.09878031
```

Mimic Excel

To new Excel learners, its sign convention is really confusing. To help students understand its implications, numerous functions are developed. Just typing `.mimicExcel` output many associated functions with/without such a sign convention, as shown below.

```

*-----*
* Mimic Excel      by yany@canisius.edu  3/27/2018  *
*-----*
* Function        Utility                  *
*-----*
* .pvExcel        .pvExcelNoSignConvention  *
* .fvExcel        .fvExcelNoSignConvention  *
* .pmtExcel       .pmtExcelNoSignConvention *
* .nperExcel      .nperExcelNoSignConvention *
* .rateExcel      .rateExcelNoSignConvention *
* .npvExcel       .npv_f                    *
* .effectExcel    .effectYan                *
* .days360Excel  *                          *
* .priceExcel     *                          *
* .yieldExcel     *                          *
*-----*
* >.pvExcel       # find out the usage of pvExcel *
* >.mimicExcel    # back to this menu           *
* >.fm            # back to the main menu       *
*-----*

```

Instant access to over 40 formulae

Finance is labeled as a quantitative subject since many formulae are used. After typing `.showFormula` or `.sf` for a short name, we would see a list of 40 formulae. Typing `.sf(2)` would print the 2nd formula instantly on our screens. This is extremely convenient since students and instructors could check any formula on his/her will.

```

function(i){
"Objective: show formula
  i  NAME
-----
  1  Install png package
  2  2-stock variance
  3  Adjusted beta
  4  Annualized Variance/standard deviation
  5  APR to another APR
  6  APR to EAR
  7  APR to Rc
  8  Bond price
  9  Call and put options
 10  CAPM (Capital Asset Pricing Model)
 11  Covariance
 12  Cumulative standard normal distribution
 13  Distribution of a normal distribution
 14  Distribution of a standard normal
 15  DuPont identity
 16  Fama-French 3-factor model
 17  Financial leverage ratios
 18  Free cash flows
 19  Future value of annuity
 20  Future value of annuity due
 21  Future value of growing annuity
 22  Future value of one present value
 23  Geometric Mean with just 3 values
 24  Liquidity ratio (accounting)
 25  Nominal vs. real rates

 26  Percentage vs. log returns
 27  Portfolio beta
 28  Portfolio return
 29  Portfolio variance
 30  Present value of annuity
 31  Present value of annuity due
 32  Present value of growing annuity
 33  Present value of growing perpetuity
 34  Present value of one future value
 35  Present value of perpetuity
 36  Profitability ratios
 37  ROA vs. ROE
 38  Sharpe ratio
 39  Sortino ratio
 40  Total returns with two components
 41  Treynor ratio
 42  Variance

Example #1>.sf      # see this list
Example #2>.sf(1)   # how to install png
Example #2>.sf(2)   # see the fv formula

```

Data cases

Based on our teaching experience, students benefit more by doing various data cases than simply solving end-of-chapter problems. This book offers about 10 data cases by using real world data. For a one-semester course, students are given around 5 to 7 data cases depending on the length of the semester (see a partial list after typing `.datacases`).

```

> .datacases
function(i){
" i   Data cases
-----
1   Estimation of an Enterprise value
2   Financial Statement Analysis (ratio analysis)
3   Sharpe and Treynor ratios
4   LPSD (Lower Partial Standard Deviation) and Sortino ratio
5   Which political party, Democratic or Republican, manages the economy better?
6   Several stocks' beta
7   Accounting fraud detection and Benford Law
8   From daily returns to 10-day, weekly, monthly or annula ones
9   VaR (Value at Risk) estimation
10  FF3, FFC4 and FF5 models
11  Simulating a Black-Scholes call option
12  Simulating Asian options
13  Slot machine simulation
14  Number of stocks vs. portfolio risk
15  Constructing an efficient frontier
16  Links

Example 1:>.dc      # show all exercises
Example 2:>.dc(1)   # see the first data case

```

Paperless

When taking this course, it is paperless. For the mid-term and final exams, all questions are written in a text file. For example, for a final term, students can just type `.final` (see the image below):

```

> .final
function(){
"
*-----*
* Final Exam                               12/13/2018 *
*-----*
* Instruction                               *
* *                                         *
* 1) There are two parts                    *
* 2) Part I: 20 questions (1 point each)    *
* 3) Part II: 2 problems plus one bonus     *
*      a) 5 points for each problem        *
*      b) 2 points for the bonus           *
*      c) you can switch one problem       *
*          with the bonus                   *
* *                                         *
* submit an Excel file to the dropbox on D2L *
*      first_name_last_name.xlsx          *
*-----*
* >.p1(1)  # for the 1st question in Part I *
* >.p2(2)  # for the 2nd problem in part II *
* >.final  # back to this menu              *
*-----*

```

All data cases and term projects work the same way, where students submit an Excel file to the Drop Box designated by their instructors.

Term projects

We firmly believe that a good term project summarizes what students have learnt by reading a book or taking a course. One chapter is devoted to this: Chapter 30: Term Projects. There are about 40 potential topics. For 20 of them, there exists a one or two-page detailed instructions (see a partial list below). Term projects are for group exercises with a maximum of 3 group members. In addition to submitting an Excel file and a Word document, students have to make a presentation in front of the whole class.

```
> .c30
function(i){
" i Chapter 30: Term projects
- -----
1 Requirements for a term project
2 Retirement calculator
3 Which one is the best? CAPM, FF3, FFC4, or FF5
4 Test of the January Effect using Excel
5 Bankruptcy prediction by using Z-score
6 Updating a monthly Excel data set and write an instruction
7 Momentum trading strategy
8 52-week high trading strategy replication
9 Max trading strategy replication
10 Spread estimation from daily price
11 Event Study using Excel
12 Monte Carlo Simulation to mimic a slot machine
13 Monte Carlo Simulation to mimic Black Jack
14 Benford Law and accounting fraud detection
15 Readability of 10-K filings and firm's performance
16 Business cycle indicator
17 illiquidity measure, Amihud (2002)
18 Liquidity measure, Pastor and Stambough (2003)
19 Spread estimation from TAQ (Trade and Quote) high-frequency data
20 A reverse mortgage calculator
21 KMV model and default probability
22 Financial statement analysis
23 Black-Litterman model
24 Brandt, Santa-Clara and Valkanov model (2009)
25 SEC filings
26 Projects taken already

Example #1:>.c30      # see the above list
Example #2:>.c30(1)  # see the first explanation
```

Over 80 YouTube videos

For many finance and Excel topics, there exist wonderful YouTube videos. For certain students, they learn better by watching these types of videos rather than sitting in a classroom listening to dry lectures. For those students, they could watch various YouTube videos listed (see a list below):

```

> .youtube
function(i){
" i  youtube for finance
-  -----
 1  YouTube (3)  Time value of money
 2  YouTube (5)  Financial statement analysis
 3  YouTube (5)  CAPM (Capital Asset Pricing Model)
 4  YouTube (6)  Multi-factor models (FF4, FFC4, FF5)
 5  YouTube (5)  Portfolio analysis
 6  YouTube (4)  Call and put options
 7  YouTube (6)  various distributions, such as normal
 8  YouTube (7)  T-test,F-test, tests of equal mean and equal variance
 9  YouTube (10) Monte Carlo Simulation
10  YouTube (6)  Credit analysis
11  YouTube (8)  Excel basics
12  YouTube (5)  Excel date,year(), month(), day()
13  YouTube (6)  Simple Macro
14  YouTube (7)  Simple VBA
15  YouTube (7)  pivot Table
16  YouTube (6)  vlookup, solver
17  YouTube (6)  Conditional formatting
18  YouTube (8)  Data input and output
19  YouTube (8)  String manipulations
20  YouTube (12) Data manipulations

Example #1:> .yt    # get the above list
Example #2:> .yt(1) # see the first explanation

```

Visual finance

Through various graphs, figures and images, students can understand finance theory better. For example, we could use sizes of \$100 values today, in one year, or in 20 years to show the concept of the time value of money.

Many web sites plus 40 references

Students and instructors could find extra resources easily. With the help of R, we have included dozens of links for various topics and over 40 published papers.

Many utility functions

To help students learn and understand Excel and finance better, many utility functions are developed, such as `.mimicExcel` and `.showFormula`. To find all utility functions, just type `.uu` (see the image below):

```

*-----*
* Utilities      -- short-cut --  *
*-----*
* .inClassEx    # .ice           *
* .getData      # .gd           .gg  *
* .finCalculator # .fincal        *
* .mimicExce    # .me           .mm  *
* .dataCases    # .dc           .dd  *
* .termProjects # .tp           .tt  *
* .showFormula  # .sf           .ss  *
*-----*
* .explainR     # .er           .ee  *
* .interactive  # .ia           .ii  *
* .usefulLinks  # .ul           .ll  *
* .references   #                .rr  *
* .youtube      # .yt           .yy  *
* .visualFinance # .vf           .vv  *
* .funs         #                .ff  *
* .midTerm      # .md           *
* .finalExam    # .fe           *
*-----*
* >.ice         # see a list of ice *
* >.uu         # back to utilites *
* >.fm         # back to main menu *
*-----*

```

No focus on Excel Macro and VBA

For this book, we would not discuss Excel macros nor VBA for two reasons. First, we hope to make this book very useful for all readers including ones who have no prior knowledge about Excel. Second, even though Macro and VBA are quite useful, we argue that R and Python are way more powerful. With the same efforts, users would benefit more by leaning towards R or Python. With this in mind, students would spend one hour for Macro and one hour for VBA. For example, students learn how to copy-and-paste others' VBA (see a list below):

```

> .c28
function(i){
" i Chapter 28: Simple VBAs          i More .....
- -----
1 Developer is not available        21 VBA 4 Black model (call on futures)
2 Copy-and-paste others' VBA       22 VBA 4 converting 23.23
3 correct file extension: *.xlsm    23 VBA 4 todayPrice() ??
4 VBA 4 doubling an input value     24 VBA 4 getting financial statements
5 VBA 4 for mean                    25 VBA 4 Cholesky decomposition
6 VBA 4 estimating the area         26 VBA 4 LPSD (Lower Partial Standard Deviation)
7 VBA 4 showFormula() function     27 VBA 4 Sortinor ratio
8 VBA 4 converting miles to km      28 VBA 4 financial statements (2)
9 VBA 4 pvGrowingAnnuity           29 VBA 4 removeErr() funciton
10 VBA 4 fvGrowingAnnuity           30 VBA 4 meanGivenProb
11 VBA 4 geometric mean:geomeanYan  31 VBA 4 varGivenProb
12 VBA 4 effective rate:EFFECTYan() 32 VBA 4 finding duplicates
13 VBA 4 NPV function: NPVyan()     33 VBA 4 finding duplicates (2)
14 VBA 4 pvPerpetuity              34 VBA 4 noRepeats
15 VBA 4 varCovariance matrix       35 VBA 4 durationYan
16 VBA 4 correlation matrix         36 VBA 4 modifed duration
17 VBA 4 PV(growing perpetuity)     37 VBA 4 bond convexity
18 VBA 4 Black-Scholes call option  38 VBA 4 bond price
19 VBA 4 Black-Scholes put option   39 VBA 4 second highest value
20 Links                            40 VBA 4 freqGivenNumber

Example #1:>.c28      # find out the above list
Example #2:>.c28(1)  # see the first explanation

```

Interactive mode

When students are actively engaged, they tend to learn better. For this reason, the interactive mode is designed. For example, it is a difficult task to convert an effective rate to another one or estimate APR (Annual Percentage Rate) with certain compounding frequencies a given APR. With interactive mode, students could enter their own interest rates with their corresponding frequencies and choose their designed interest rates for output.

First and last weeks

When taking “Financial Modeling using Excel” with this book, the structures of all lectures are quite similar (see the first week’s menu below):

```

*-----*
* Financial Modeling with Excel 2018 yany@canisius.edu *
*-----*
* 1: R installation/Excel basics * 16: R basics *
*-----*
* >.c1 # go to chapter 1 (a dot in front c1) *
* >.c16 # go to chapter 16 *
* >.fm # back to the main menu *
*-----*

```

And below is the last week's menu:

```

*-----*
* Financial Modeling with Excel 2018 yany@canisius.edu *
*-----*
* .c1 R installation/Excel basics .c16 R basics *
* .c2 Time value of money .c17 Excel basics (II) *
* .c3 Financial statement analysis .c18 Data sources *
* .c4 Risk vs. return .c19 Utility functions *
* .c5 T-test, F-test .c20 Issues with Excel *
* .c6 Bond and stock evaluation .c21 vlookup, solver *
* .c7 CAPM .c22 Data input *
* .c8 FF3, FFC4, FF5, etc. .c23 Data manipulation *
* .c9 Various distributions .c24 Data output *
* .c10 Black-Scholes option model .c25 Simple graph *
* .c11 Monte Carlo Simulation .c26 Excel matrix *
* .c12 VaR (Value at Risk) .c27 Simple Macros *
* .c28 Simple VBAs *
* .c30 Term projects *
*-----*
* >.c27 # go to chapter 27 *
* >.uu # go to utilities *
* >.fm # back to the main menu *
*-----*

```

Easy to modify and extend

Since all programs are prewritten and publicly available, the instructor would not spend extra time if he/she wants adopt the same teaching methodology. In other words, the instructors do not need to spend time on those programs. On the other hand, an instructor could easily modify those files since they are all written in a text format.

Instructors' tool box

For this course, we supply several tools for a potential instructor, such as `.schedule()` and `.weekly()` functions. For example, today is September 7. When launching R, the following schedule would pop up.

	Date	Tasks
1	09/08 (Friday)	Senate meeting SH1013 2:00pm-4:00pm
2	09/07 (Thursday)	FIN414 and FIN455

It tells us that we have to teach FIN414 and FIN455 today and tomorrow we would have a senator meeting starting from 2:00pm to 4:00pm. The input file has a very simple structure with a text format (see the first several lines below). Another beauty of such an input file is that we could use it next year with minor modification.

```

schedule.txt - Notepad
File Edit Format View Help
#schedule.txt 1)keep those first two lines 2) no single quotation!!
date;task
9/18; Monday at 8:30am Dental
9/19; data analytics meeting
9/29; Business school meeting at 2:00pm
# *-----Senate meeting -----*
9/8; Senate meeting SH1013 2:00pm-4:00pm
10/6; Senate meeting SH1013 2:00pm-4:00pm
11/10; Senate meeting SH1013 2:00pm-4:00pm
12/8; Senate meeting SH1013 2:00pm-4:00pm
2/9; Senate meeting SH1013 2:00pm-4:00pm
3/9; Senate meeting SH1013 2:00pm-4:00pm
4/13; Senate meeting SH1013 2:00pm-4:00pm
5/4; Senate meeting SH1013 2:00pm-4:00pm
# *-----Teaching fall 2017-----*
8/29;FIN414 and FIN455
8/31;FIN414 and FIN455
9/5;FIN414 and FIN455
9/7;FIN414 and FIN455
9/12;FIN414 and FIN455
9/14;FIN414 and FIN455
9/19;FIN414 and FIN455
9/21;FIN414 and FIN455
9/26;FIN414 and FIN455
9/28;FIN414 and FIN455

```

For our teaching practices, we have a short check-list before each lecture. This short list could include several items, such as attendance list, which chapter or contents to be covered, which data cases to be distributed, which in-class exercise and the like. For this purpose, we have designed a function called `.weekly()`, see one example below. The output is for the first week of Financial Modeling using Excel.

```

> .weekly(2)
cat(.weekly2)
////////////////////////////////////
1) Attendance list
2) =PV(
3) =FV(
4) =Nper(
5) =rate(

Second day
-----
1) Attendance list
2) NPV rule
3) a true NPV function
4) effective rate conversion
5) data case #1

////////////////////////////////////

```

In this case, we have two classes for each week. Another beauty is that we could modify this text file quite easily when we have something left over for the next class.

What this book covers

Chapter 1, R installation and Excel Basics, explains how to install R software and teaches many basic Excel concepts such as Excel being a two dimensional spreadsheet and relative and absolute addresses.

Chapter 2, Time value of Money, reviews basic concepts of finance: time value of money, various formulae to estimate present and future values.

Chapter 3, Financial Statement Analysis, first discusses the design of the balance-sheet, income statement and cash flow statement, then several important ratios such as the current ratio, debt equity ratio and DuPont identity.

Chapter 4, Risk vs. Return, introduces various definitions of return, such as total return, dividend yield, capital gain yield, time-weighted return vs. dollar weighted returns, various definitions of risk (such as variance, standard deviations, LPSD (lower Partial Standard Deviation)) and trade-offs between benefit (returns) and cost (risk): Sharpe ratio, Treynor ratio, Sortino ration and a utility function.

Chapter 5, Interest rate and bond/stock evaluation, starts with a discussion of various definitions of rates, APR (annual percentage rate), EAR (Effective Annual Rate), how to convert one effective rate to another one, and how to evaluate bond and stock.

- Chapter 6, T-test, F-test and normality test*, discusses various import tests for learning finance and conducting empirical research: T-test, F-test, χ^2 test and normality tests.
- Chapter 7, CAPM*, reviews the CAPM (Capital Asset Pricing Model), the simplest one-factor linear model to estimate the cost of equity.
- Chapter 8, Fama-French 3 factor model and other multi-factor models* extends CAPM, discussed in the previous chapter, to various multi-factor models such as FF3, FFC4 and FF5.
- Chapter 9, Various distributions*, discusses uniform distribution, normal distribution and their related Excel functions.
- Chapter 10, Black-Scholes-Merton option model*, discusses the concepts of options in detail: call, put and the famous Black-Scholes-Merton call and put models. In addition, various trading strategies involving options are explained in detail.
- Chapter 11, Monte Carlo Simulation*, offers a short introduction to MCS, and explains how to generate various types of random numbers (such as from an evenly distribution and a normal distribution), and how to simulate stock prices and returns.
- Chapter 12, VaR (Value at Risk)*, explains another important risk measure: VaR and procedures on how to estimate VaR for individual stocks and portfolios.
- Chapter 13, Liquidity measure and high-frequency data*, first explains why liquidity measure is important, then introduces several measures such as Illiquidity measure, Amihud (2002), Pastor and Stambough (2003) liquidity measure. In addition, students use free high-frequency data to measure spread and relative spread to verify different liquidity measures generated by low-frequency data such as daily or monthly data.
- Chapter 14, Portfolio Theory*, discusses many aspects related to portfolio analysis such as definitions of covariance, correlation, and how to estimate the variance covariance matrix.
- Chapter 15, Credit Risk Modeling*, explains the spread, the relationship between yield spread and credit rating, Z-score and credit spread migration matrix.
- Chapter 16, R basics*, is an optional chapter, which means that readers who are afraid of programming could safely skip this chapter. In this 8-page long short chapter, we discuss how to download R software, launch/quit R and about 2 dozen basic concepts, such as whether R is case sensitive, and how to assign a value to a new variable.
- Chapter 17, Excel Basics (II)*, offers more basic Excel concepts in addition to those introduced in Chapter 1: R installation and Excel Basics.

- Chapter 18, Data Sources*, lists all public data courses used in this book for Economics, Finance and Accounting. To get the major menu, we simply type `.getdata`.
- Chapter 19, Utility Functions*, lists the so-called utility functions for learning Excel, such as `.getdata` (get all types of public data), `.mimicExcel`, `.finca1` (a free financial calculator), `.midTerm`, `.finalExam`, `.dataCases` and `.termProjects`.
- Chapter 20, Issues with Excel*, explains several issues with Excel such as the Excel sign convention, how to treat blanks and inconsistencies for several Excel functions. One example of such an inconsistency is that `stdev()` is for sample, while `covar()` is for population.
- Chapter 21, Vlookup and solver*, explains two extremely useful Excel functions called `vlookup()` and solver procedure.
- Chapter 22, Data Input*, offers detailed explanations for various input methods: csv (comma separated value), text file and from web links.
- Chapter 23, Data Manipulation*, shows many ways to manipulate input data such as converting daily returns into weekly, monthly or annual ones, how to construct a good date variable and how to merge stock data with index data by date,
- Chapter 24, Data Output*, shows several output formats (e.g., csv format, text format) to save our data.
- Chapter 25, Simple graphs*, offers a short introduction, and explains how generate an x-y graph, bar, and chart as well as add titles and legends.
- Chapter 26, Excel Matrix Manipulation*, explains concepts of rows, columns, matrices and how to use Excel function such as `mmult()` and `transpose()` to manipulate them.
- Chapter 27, Simple Macros*, focuses on how to record a simple macro and how to copy-and-paste others' macros.
- Chapter 28, Simple VBAs*, similar to the previous chapter, focuses on how to copy-and-paste other's VBAs. In total, around 2 dozen VBAs are available for students to practice on.
- Chapter 29, Pivot table*, explains how to use the Pivot Table to solve various problems. One example is how to convert daily returns into weekly, 10-day, monthly or annual ones.
- Chapter 30, Term Projects*, offers a list of 40 potential topics for a term paper. For many of them, there exists a one or 2-page detailed description on how to download and process data.