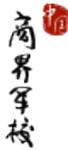




# PHBS

北京大学汇丰商学院



## FIN-516

### Financial Modeling in VBA

### Fall Semester, Mod. 3, 2018-2019

#### Course Information

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##### **Instructor:**

Fritz Koger, CFA, PhD

Office: PHBS Building, Room 752

Phone: It is best to contact me via email.

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Office Hours: 08:00 – 09:00, Monday

##### **Teaching Assistant:**

Teaching Assistant: Veronica, 张诗琪, Shiqi Zhang, 1701213153 in 2017 Finance

WeChat: zsq96512; cell phone: 18955863191

TA Review Sessions: N/A

##### **Classes:**

Lectures: Monday and Thursday, 8:30 – 10:20

Venue: PHBS Building, Room 401 (Final Exam: Room 501, **April 22, 2019**)

##### **Course Website:**

N/A

**Koger's Financial Modeling was selected for the Excellence Course Award by Peking University in 2017.**

## 1. Course Description

### 1.1 Context

#### Course overview:

This course is intended for the student who wishes to learn how to utilize financial theory in real world applications in a more profound manner. In Financial Modeling in VBA (*FMVBA*), students will learn and master Excel's user-defined capabilities. Such extensions include repetitive calculations lacking branches/loops captured via Excel's *Macros* as well as more advanced models using Excel's powerful programming language, *Visual Basic for Applications (VBA)*, which allows for conditional branching and looping. Students of *FMVBA* will develop financial models in a breadth of topics. However, the focus of *FMVBA* will be on applications in which *VBA* is most valuable. In addition to conditional branching and looping, *VBA* is useful for modeling user-defined functions of multi-variables, e.g., Black-Scholes. Such calculations can be done more efficiently with user-defined functions, *especially* those buried inside other analyses. Indeed, more complex (i.e., multi-step) functions inside of repetitive calculations (e.g., Monte Carlo analysis) can really *only* be done via *VBA*. In short, whereas casual Excel users do *not* need user-defined programs, such tools are indispensable for professional practitioners of finance.

**Course Prerequisites:** *Financial Modeling, Asset Valuation Theory, Corporate Finance, and Investments* are all helpful in preparing the student for FMVBA. Knowledge of computer programming is also helpful, though not absolutely necessary. The professor reserves the right to screen students based on their background.

## 1.2 Textbooks and Reading Materials

Simon Benninga, “*Financial Modeling*”, 3<sup>rd</sup> Ed., 2008, Massachusetts Institute of Technology, ISBN: 978-0-262-02628-4

### Additional References and Supplemental Textbooks:

“*Financial Modeling in Excel*”, Koger, F, forthcoming in PKU Press.

Michael Rees, “*Financial Modeling in Practice*”, 2008, Wiley Finance, ISBN: 978-0-470-99744-4.

Mary Jackson and Mike Staunton, “*Advanced Modelling in Finance using Excel and VBA*”, 2001, Wiley Finance, ISBN-13: 978-0-471-49922-0.

John Charnes, “*Financial Modeling with Crystal Ball and Excel*”, 2012, Wiley Finance, ISBN 978-1-118-17544-6.

Simon Benninga, “*Principles of Finance with Excel*”, 2006, Oxford University Press, ISBN-13: 978-0-19-530150-2.

Isaac Gottlieb, “*Next Generation Excel, Modeling in Excel for Analysts and MBAs*”, 2010, John Wiley and Sons, ISBN: 978-0-470-82473-3.

John Walkenbach, “*Microsoft Excel 2010 Power Programming with VBA*”, 2010, Wiley Publishing, Inc., ISBN-978-0-470-47535-5

## 2. Learning Outcomes

### 2.1 Intended Learning Outcomes

Learning Goals	Objectives	Assessment
1. Our graduates will be effective communicators.	1.1. Our students will produce quality business and research-oriented documents.	
	1.2. Students are able to professionally present their ideas and also logically explain and defend their argument.	
2. Our graduates will be skilled in team work and leadership.	2.1. Students will be able to lead and participate in group for projects, discussion, and presentation.	
	2.2. Students will be able to apply leadership theories and related skills.	
3. Our graduates will be trained in ethics.	3.1. In a case setting, students will use appropriate techniques to analyze business problems and identify the ethical aspects, provide a solution and defend it.	
	3.2. Our students will practice ethics in the duration of the program.	
4. Our graduates will have a global perspective.	4.1. Students will have an international exposure.	
5. Our graduates will be skilled in problem-solving and critical thinking.	5.1. Our students will have a good understanding of fundamental theories in their fields.	
	5.2. Our students will be prepared to face problems in various business settings and find solutions.	
	5.3. Our students will demonstrate competency in critical thinking.	

## 2.2 Course specific objectives

*FMVBA* will spend a small amount of time (up to 20% of course time) *introducing topics* for which there is simply no time during *FM*. Otherwise, the remaining 80%+ of *FMVBA* *introduces the power of (macros and) VBA*.

The course is practical in nature. Upon completion of the course, the student will be fluent in not only Excel and financial modeling, but also Macros (which generate VBA code) and *VBA* directly. Such fluency will position him/her very well for essentially any introductory financial job. The student will also have a nice tool kit of many real world financial models across a very broad range of topics. This combination of fluency of advanced financial modeling and portfolio of models will prove invaluable during both interviews with potential employers as well as execution of finance-related employment tasks.

The professor has two primary goals: arm the student with

- (1) many practical financial Excel models and
- (2) programming knowledge of Excel, its Macros (which generate VBA code used in repetitive calculations) and *VBA* in order to develop his/her own models as the need arises in his/her professional and personal life.

Each student is required to possess a laptop equipped with Excel and *VBA*.

*FMVBA* is very "hands-on", with most of the grade determined via demonstration of building models via group (homework) projects. Group membership numbers six (6) and will be determined by the students themselves by the fourth lecture. (The professor is happy to assign groups to those students who prefer not to choose their own group members.) The purpose of group homeworks/projects is to reinforce and to extend the student's knowledge regarding models built during lectures.

The final exam will be easier if you have actively participated in the group projects. Otherwise, the final exam will likely be beyond the student's capability.

## 2.3 Assessment/Grading Details

**Course Guidelines:** There are two overarching themes: the professor's aims are to (1) be as fair as possible to everyone, and (2) create the optimal learning environment for everyone! The professor firmly believes that treating individuals differently is inherently unfair. Thus, everyone will be treated the same.

The student's final grade will be

$$\begin{aligned} & \mathbf{10\% \text{ (Professor's Subjective Evaluation)}} \\ & \mathbf{+ 40\% \text{ (Average of student's Group Project Scores*)}} \\ & \mathbf{+ 50\% \text{ (Individual Final Exam Score).}} \end{aligned}$$

**\*Group Peers' Subjective Evaluation:** Each student will self-select into groups of six (6) students. (The professor will assign any student to a group who chooses not to self-select.) Evaluations from each student's group peers will be done during the final week of the module. *NO HUMAN BEING OTHER THAN THE PROFESSOR WILL SEE ANY STUDENT'S EVALUATIONS; NOT EVEN THE TAs*. These evaluations will factor into the "Average of student's Group Project Scores". So a student who receives his/her proportional weight from his peers' evaluations will have a *factor of 100%*. A student who receives more (less) than his/her proportional weight will have a *factor greater (less) than 100%*.

**FINAL EXAM:** If the student has actively participated in all project work, if the student has attended all lectures, if the student has kept up with textbook lecture readings, and if the student has studied carefully any lecture notes provided by the professor, then the final exam will be straightforward. *Otherwise, the student will likely be incapable of negotiating it.*

**FINAL EXAM GUIDELINES:** Please review carefully the guidelines. *If the student is uncomfortable with these, then the student should not take this course.* The professor will grade that which is handed in on time. The final exam will either be completed in Excel along with its extensions and/or hand written. **THE STUDENT SHOULD PREPARE FOR BOTH TYPES OF FINAL EXAMS DURING THE SEMESTER, AS**

BOTH TYPES ARE POSSIBLE. (Students will be informed of the exact nature of the exam no later than the final course lecture.) If part/all of the exam is performed via computer, the professor will grade that which is saved onto the student's USB (thumb) drive. If the student can NOT confidently work quickly and efficiently and save your work afterward, then he/she should NOT take the course. The student who chooses to take the final exam with inferior equipment does so at his own peril.

**Professor's Subjective Evaluation:** This is based in part, on his/her punctuality, attendance, classroom behavior, attitude, preparedness, etc... Per PHBS policy, if he/she is absent 6 (or more) lectures, then he/she *automatically fails* the course. The professor appreciates the student letting him know *in advance* if he/she will be tardy or absent. However, this does not excuse an absence. Please note that the number of absences is independent of whether or not they are approved by the University or HSBC Business School. (The professor does *not* distinguish between approved or unapproved absences.) Also, the professor does *not* sign PHBS forms related to the student's planned absence(s).

To minimize classroom disruptions, the professor strongly urges the student to be punctual. All announcements are made at the beginning of class, making punctuality all the more important. If you miss a lecture, you are responsible for material covered. *Secure information missed from a fellow student*, not from the professor.

Disturbing class lectures will negatively impact the student's subjective evaluation. Talking during class, having a cell phone ring, etc... are disturbances that are unacceptable. These rules are designed to optimize the learning environment for all students.

## **2.4 Academic Honesty and Plagiarism**

This class will be conducted in full accordance with PKU's policies regarding academic integrity. Anyone caught cheating will be punished as severely as the school permits.

On group projects, each group is to work independently of other groups. Whereas it is OK for students between different groups to consult each other, each group's deliverable should be independently developed. Simply copying one group's project by another group will result in penalties for *both* groups. For the final (individual) exam, no consultation between students is allowed. The final (individual) exam is to be solely developed by each individual, with no assistance of any kind from any other person. Again, policies are designed with fairness in mind.

**Educational Norms and Expectations:** The student is responsible for material covered in any class. If a student misses a class, he/she should retrieve lecture notes from a classmate. It is in the student's best interest to *read any assigned material BEFORE the lecture*. That way, the student will find the lecture period to be much more productive.

**Suggestions for improving the course:** The professor is committed to making this course as good as possible. If the student has suggestions to improve the course, he/she should inform the professor, *IN PRIVATE*. (During a lecture is *not* the appropriate time for such feedback, as there is no time during the lecture for such discussions.) The course is obviously for the student's benefit, not the professor's. So any feedback is greatly appreciated and is seriously considered.

**Add/Drop the Course:** Per PHBS policy, the student is not allowed to add or drop this course after the first week.

Any issue not specifically addressed here will be handled at the discretion of the professor.

It is important for a student's effort and credit to be recognized through class assessment. Credits earned for a student work due to efforts done by others are clearly unfair. Deliberate dishonesty is considered academic misconducts, which include plagiarism; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement;

or altering, forging, or misusing a University academic record; or fabricating or falsifying of data, research procedures, or data analysis.

All assessments are subject to academic misconduct check. Misconduct check may include reproducing the assessment, providing a copy to another member of faculty, and/or communicate a copy of this assignment to the PHBS Discipline Committee. A suspected plagiarized document/assignment submitted to a plagiarism checking service may be kept in its database for future reference purpose.

Where violation is suspected, penalties will be implemented. The penalties for academic misconduct may include: deduction of honour points, a mark of zero on the assessment, a fail grade for the whole course, and reference of the matter to the Peking University Registrar.

For more information of plagiarism, please refer to *PHBS Student Handbook*.

### 3. Topics, Teaching and Assessment Schedule

Lecture	Dates	Lecture Topics	Projects
1	Mon., Feb. 18, 2019	VBA Example: Loan Amortization; debug via MsgBox, via pause/break mode and via Immediate window; install Developer tab from Options, and install optimal VBE Option settings from with VB Editor Tools Options;	
2	Thurs., Feb. 21, 2019	VBA Basics: recording Macros, VBE, R1C1, simple commands, VBA quick reference handout; personal macro workbook; ``With Blocks'' via multi-series scatter-plot macro;	
3	Mon., Feb. 25, 2019	Absolute reference Vs. relative reference; various operators; MsgBox;	
4	Thurs., Feb. 28, 2019	InputBox, arrays (static and dynamic), For loops, Range object;	<i>Group Selections Due, 8:25, Mon. Mar. 04</i>
5	Mon., Mar. 04, 2019	Collections of objects; For Each...Next loops;	<i>Group Selections Due, 8:25</i>
6	Thurs., Mar. 07, 2019	VBA Goal Seek; user buttons for Macros/SUBs; Branching: (1) IF lines and blocks, (2) Select case (3) GoTo Statement;	
7	Mon., Mar. 11, 2019	Looping constructs (For loops, Do loops [While condition; Until condition]);	
			#1, Wed., Mar. 13, <i>14:00</i>
8	Thurs., Mar. 14, 2019	SUBs; debug via stepping (step: into, out of, over; run to cursor); project #2: numerical method;	
9	Mon., Mar. 18, 2019	FUNCTIONs;	
			#2, Wed., Mar. 20, <i>14:00</i>
10	Thurs., Mar. 21, 2019	Binomial model (stock prices; European options; American options); project #3: numerical method and binomial model; HANDOUTS: constants and variables (names, scopes, data types); error handling in Subs, Functions;	
11	<b>SAT., Mar. 23, 2019</b>	More on generating random variables and their distributions in VBA, including correlated random variables; Cholesky	<b>Make-up Date</b>
12	Mon., Mar. 25, 2019	More Monte Carlo analysis, estimate of Pi in VBA; Generating and plotting simulated stock prices; project #4: gold mine using Monte Carlo analysis; correlated random variables in VBA	
13	Mon., Apr. 01, 2019	Black Scholes function; (Options) portfolio payoffs at expiration; data tables in VBA	
			#3, Wed., Apr. 03, <i>14:00</i>
14	Thurs., Apr. 04, 2019	Replicating portfolios that include non-existent options; project #5: review Newton Raphson numerical method	
15	Mon., Apr. 08, 2019	Bonds, including convexity and duration in VBA; price-yield approximations; other price sensitivities	
			#4, Wed., Apr. 10, <i>14:00</i>
16	Thurs., Apr. 11, 2019	liability immunization via bond portfolios; project #6:	
17	Mon., Apr. 15, 2019	Bond expected return calculations using multi-period credit rating transition matrices;	
			#5, Wed., Apr. 17, <i>14:00</i>
18	Thurs., Apr. 18, 2019	Tying-up loose ends in VBA and more examples.	
<b>Final EXAM</b>	Mon., Apr. 22, 2019	<b><u>8:30 – 10:30</u></b>	Room 501

Chapters in Simon Benninga, “*Financial Modeling*”, 3<sup>rd</sup> Ed., 2008, Massachusetts Institute of Technology, ISBN: 978-0-262-02628-4.

A PDF of course lecture notes related to the pre-requisite, Financial Modeling, is also provided.

<b>Part</b>	<b>Chapter</b>	<b>Title</b>
<b>Part 1</b>		<b>CORPORATE FINANCE MODELS</b>
	<b>1</b>	Basic Financial Calculations
	<b>2</b>	Calculating the Cost of Capital
	<b>3</b>	Financial Statement Modeling
	<b>4</b>	Building a Financial Model: PPG Corporation
<b>Part 2</b>		<b>PORTFOLIO MODELS</b>
	<b>8</b>	Portfolio Models – Introduction
	<b>9</b>	Calculating Efficient Portfolios with No Short Sale Restrictions
	<b>10</b>	Calculating the Variance-Covariance Matrix
	<b>12</b>	Efficient Portfolios without Short Sales
	<b>14</b>	Event Studies
	<b>15</b>	Value at Risk
<b>Part 3</b>		<b>OPTION-PRICING MODELS</b>
	<b>16</b>	An Introduction to Options
	<b>17</b>	The Binomial Option-Pricing Model
	<b>18</b>	The Lognormal Distribution
	<b>19</b>	The Black-Scholes Model
	<b>20</b>	Option Greeks
	<b>21</b>	Portfolio Insurance
	<b>22</b>	An Introduction to Monte Carlo Methods
	<b>23</b>	Using Monte Carlo Methods for Option pricing
	<b>24</b>	Real Options
<b>Part 4</b>		<b>BONDS</b>
	<b>25</b>	Duration
	<b>26</b>	Immunization Strategies
	<b>27</b>	Modeling the Term Structure
	<b>28</b>	Calculating Default-Adjusted Expected Bond Returns
<b>Part 5</b>		<b>TECHNICAL CONSIDERATIONS</b>
	<b>29</b>	Generating Random Numbers
	<b>30</b>	Data Tables
	<b>31</b>	Matrices
	<b>32</b>	The Gauss-Seidel Method
	<b>33</b>	Excel Functions
	<b>34</b>	Using Array Functions and Formulas
	<b>35</b>	Some Excel Hints
<b>Part 6</b>		<b>INTRODUCTION TO VISUAL BASIC APPLICATIONS</b>
	<b>36</b>	User-Defined Functions with VBA
	<b>37</b>	Types and Loops
	<b>38</b>	Macros and User Interaction
	<b>39</b>	Arrays
	<b>40</b>	Objects and Add-Ins
	<b>41</b>	Information from the Web
	<b>Appendix 1</b>	Excerpts from the Help File
	<b>Appendix 2</b>	The R1C1 Reference Style

#### 4. Miscellaneous