Principles of Finance with Excel®

THIRD EDITION

Simon Benninga
Tal Mofkadi

OXFORD
UNIVERSITY PRESS

Principles of Finance

with Excel®

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New York Oxford
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Published in the United States of America by Oxford University Press
198 Madison Avenue, New York, NY 10016, United States of America.

Library of Congress Cataloging-in-Publication Data
Names: Benninga, Simon, author. | Mofkadi, Tal, author.
Title: Principles of finance with Excel / Simon Benninga, Tal Mofkadi.
Description: Third edition. | New York : Oxford University Press, 2017. | Revised edition of Principles of finance with Excel, 2011. | Includes index.
Identifiers: LCCN 2017021661 (print) | LCCN 2017033336 (ebook) | ISBN 978–0–19–029640–7 (eBook) | ISBN 978–0–19–029638–4 (hardback)
Subjects: LCSH: Finance—Data processing. | Microsoft Excel (Computer file) | Capital assets pricing model. | BISAC: BUSINESS & ECONOMICS / Corporate Finance. | BUSINESS & ECONOMICS / Finance. | BUSINESS & ECONOMICS / General.
Classification: LCC HG173 (ebook) | LCC HG173 .B463 2017 (print) | DDC 332.0285/554—dc22
LC record available at https://lccn.loc.gov/2017021661

9 8 7 6 5 4 3 2 1

Printed by Edwards Brothers Malloy, United States of America
Printed in the United States of America

This book is dedicated to our families:

The Benninga family: Terry, Noah, Sara, and Zvi

The Mofkadi family: Lizzie, Danielle, Daphne, and Emma

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PREFACE

Finance is the study of financial decision making. Individuals and companies make financial decisions every day, and it's important to make them wisely. *Principles of Finance with Excel,* Third Edition (PFE3) will teach you how to make these decisions by providing both the theory and the implementation of wise financial decision making. It will also teach you how to express your decisions using Excel.

Learning to do finance with Excel serves two purposes: It teaches you an important academic and practical subject (finance), and it teaches you how to implement financial analysis using the most important tool (in most cases, the *only* tool) for financial analysis (Excel). Your knowledge of both finance and Excel will be enhanced by carefully working through the examples and exercises in each chapter.

Finance is a very practical discipline. Most readers of this book are studying finance not only to increase their understanding of the valuation process but also to get answers to practical problems. You will find that the extensive computation required in this book will not just enable you to get numerical answers to important problems (though that alone would justify the Excel-centered focus of this book)—it will also deepen your understanding of the concepts involved. The skills in this book are required no matter what your role in the corporation is.

Changes in the Third Edition

This third edition incorporates a number of important changes. The structure of the book has been streamlined, so the reader goes straight into the heart of finance—time value of money and discounting. Examples have been updated and most now refer to the post-2008-crash financial world and the relatively low interest rate financial environment. We worked on making the discussion in each chapter as self-contained as possible and updated the content of each chapter. The end of chapter questions are labeled to enable more efficient and focused practice for each topic. As in the first and second editions, we include an Excel "primer" in the six chapters at the end of the book.

The third edition uses Excel 2016 throughout.[1] The chapter spreadsheets and exercise solution files for the end-of-chapter exercises may be found on the Benninga *Principles of Finance with Excel*, Third Edition websites (found at www.oup.com/us/benninga). Solutions are provided only on the instructor

[1] For readers using earlier versions of Excel—a Compatibility Pack is available from http://support.Microsoft.com. This pack, once installed, allows you to read all the spreadsheets with this book in earlier versions of Excel.

website. Extra questions with detailed solutions for self-practice are provided on the student website.

The third edition of the book is divided into five parts. The first part covers capital budgeting and basic valuation concepts. The second part discusses uncertainty, portfolio analysis, and asset pricing principles. The third part covers securities valuation such as stocks and bonds. Part Four is dedicated to the understanding of options. And the fifth part provides a primer on Excel techniques.

Prerequisites—What Excel Background Is Required for *Principles of Finance with Excel*?

This book will teach you—alongside finance—all the Excel concepts needed for finance. However, you should not expect the book to be a complete Excel text. We expect that, before you start your finance course, you will know how to do the following things in Excel (just in case—many of these topics are covered in Chapter 21):

- Open and save an Excel workbook
- Use basic Excel functions, such as **Sum( )** ...
- Format numbers—here's an example of something that is usually not explained in the text:

	A	B	C	D	E
1	–$6,144.57	<-- =PV(10%,10,1000)			
2					
3	–6,144.57	<-- In many cases we prefer this format			

- Use absolute and relative values in copying and formulas

Somewhat More Advanced Excel Concepts

Chapters 22 to 26 cover a grab bag of other Excel concepts used in PFE3. You can refer to these chapters as you need them:

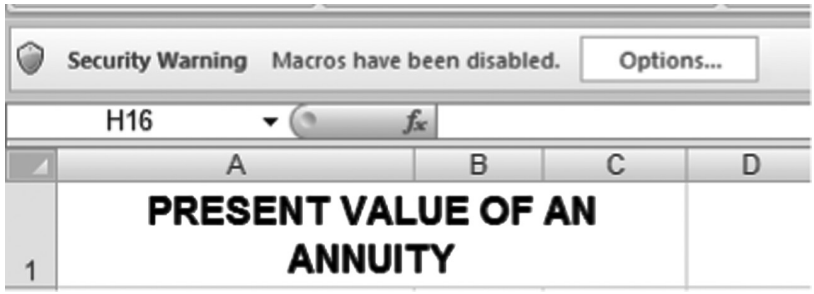
- **Charts in Excel:** Advanced charting techniques are explained in Chapter 22.
- **Excel functions:** Most of the Excel functions required for this book are explained the first time they occur. Chapter 23 is a compendium of these explanations and may be useful for reference.
- **Data tables:** "Data table" is Excel jargon for "sensitivity table." The data table technique is a little tricky, but it is well-worth learning (for some reason, data tables are often not covered in introductory Excel courses). Although the early chapters of PFE3 avoid the use of data tables, their use is required in later chapters of the book. Chapter 24 will teach you how to use data tables.

- **Goal Seek and Solver:** Excel's optimization tools are discussed in Chapter 25.
- **Dates in Excel:** Many finance computations require the use of dates. This topic is covered in Chapter 26.

Data Files for PFE3

As noted above, each chapter is accompanied by two types of spreadsheet files which are provided on the PFE3 companion websites (http://global.oup.com/us/Benninga). The first type—named, for example, **PFE3_ch02.xlsm** or **PFE3_ch15.xlsm**—contains spreadsheets for all the examples covered in than chapter. The second type of spreadsheet provides the solutions to the end of chapter exercises in a given chapter—for example, **PFE3_ch02_solutions.xlsm** for chapter 2.

When you open a PFE3 spreadsheet, you may see the following message informing you that there is a macro attached to the spreadsheet:



This message refers to a little program (in Excel jargon: a "macro") which dynamically updates cell references, so that output like the following will automatically retain the correct cell references even if you move things around or add rows:

	A	B	C	D
1	**CALCULATING PRESENT VALUES WITH EXCEL**			
2				
3	X, future payment	100		
4	n, time of future payment	3		
5	r, interest rate	6%		
6	Present value, $X/(1+r)^n$	83.96	<-- =B3/(1+B5)^B4	
7				
8	**Proof**			
9	Payment today	83.96		
10	Future value in n years	100	<-- =B9*(1+B5)^B4	

Clicking on the **Options . . .** box gives you another box, in which you can safely click **Enable this content**.

You can safely enable this macro.[2]

A Final Word

Professor Simon Benninga is the force behind this book—and is widely considered one of the "Fathers" of Financial Modeling. He and I worked together on the third edition, and he spent hours explaining to me why he presented material the way he did so that I could understand this book as well as he did. Sadly, after completing the third edition manuscript revisions, Professor Benninga passed away. Simon dedicated much of his life to research, teaching, and the dissemination of information about finance and financial analysis. He was an incredibly generous person and was in personal contact with thousands of instructors and students who used this book, including many who are mentioned in the Acknowledgements. His goals were always to help others teach financial analysis more effectively. I hope you find this book as inspiring as he was. The third edition is dedicated to the memory of Simon Benninga and to his great works. I hope you will feel free to contact me if you have any comments or suggestions about this edition.

Tal M

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[2] There is a document (**GetFormula.doc**) on the companion website showing you how to put this macro into any spreadsheet you will want to create.

ACKNOWLEDGMENTS

This book has benefitted from the many wonderful comments from readers over the years. University instructors, financial professionals, and students have all chipped in to make PFE3 a better book. Students at a number of colleges and universities—including The Wharton School of the University of Pennsylvania, The Kellogg School of Management of Northwestern University, Tel Aviv University, Gonzaga University, Rutgers University, Rider University, Tulane University, and Copenhagen Business School—have been unwitting guinea pigs for the materials and we thank them as well.

We thank our families—The Benninga family: Terry, Noah, Zvi, and Sara and the Mofkadi family: Lizzie, Danielle, Daphne, and Emma—for their support and encouragement throughout the writing and development process. The weeks and months we invested in this book were surely taken away from them. We've tried to carefully note all the people who've been helpful along the way, and we apologize in advance for any people we have missed.

Third Edition: Faruk Balli, Massey University; David Florysiak, Munich School of Management; Lei Gao, University of Memphis; Thomas Henker, Bond University; Dr. Rodrigo Hernandez, Radford University; Richard Herron, Baruch College, CUNY; Ivan Francisco Julio, Mount Olive College; Mohammad Khoshnevisan, Ajman University of Science and Technology; Loni Oz, The Interdisciplinary Center Herzliya; Fabrice Riva, IAE de Lille; Saurav Roychoudhury, Capital University; Itay Sharony, Tel-Aviv University; Sara Shirley, Roger Williams University; Steven Slezak, Cal Poly; Oranee Tawatnuntachai, Penn State Harrisburg; Jorge Salas Vargas, Autonomous University.

Second Edition: Meni Aboudy, Olaf Alex, Andrei Belogolov, Kenrick Chatman, Yaron Chechick, Sushil Dudani, Michael Ezewoko, Eugene Floyd, Yilmaz Guney, Loo Choo Hong, Patrick Johnson, Michael Kesner, Susan Kleinmann, Ken Kotansky, Mingsheng Li, Juan Mendoza, Andrew Naporano, Michelle O'Neill, Joseph Pagliari, Jr., Warren Palmer, Art Prunier, Csoma Róbert, Gerald Strever, Ilya Talman.

First Edition: Meni Aboudy, Ilan Adam, Gil Aharony, Mazin A., M. Al Janabi, Thomas C. Altman, Clifford S. Ang, Tom Arnold, Chana Arnon, Naftali Arnon, Almaz Asylbek, Dan Atzmon, Erik Austin, Daniel Bachner, Robert Balik, Keshav Baljee, Naomi Belfer, Helen Benninga, Ricardo Botero, Reider Bratvold, Lucas Brown, Yoshua Carhuamaca, P. J. Carroll, Lydia Cassorla, Elizabeth Caulk, David Centeno, Le Chang, Peter Chepets, Nikolai Chuvakhin, Marcus Cole, Robin Desman, Daniel Diamant, Ian Dickson, Bjarne Eggesbo, Patricia A. Ellenburg, Etune Emelieze, Jon Fantell, Yiktat Fung, Brian Fusco, Denis Gaiovy, Terry Garden, Glenn Gaston, Fan Ge, Gary Glassie, Kobi Glazer, Randy

Gordon, Kenji Goto, Michael Grant, Jonathan Gray, Pallav Gupta, George Guzzi, Kim Hale, Mark Helmantel, Raoul Hermens, Charlyn Ho, Reginald Holden, James W. B. Hole, Cesar Hurtado, Mafaz Ishaq, Ryan Scott Jackson, Youngsoo Kim, Itzik Kleschelski, Pierre Kohn, Timo Korkeamaki, Krushna Kumaar, Jeff S. Lee, Rowan Legg, Ross Leimberg, Björn Leonardz, Shai Leshkowitz, Daniel Leung, Hui Li, Shulin Liu, Paul Malherbe, Ariela Markel, Carlos Martinez, William Matthaei, Walter McGuire, Steve Medwin, Michael Miles, Kirill Mokh, Igor Morais, Eran Mordechai, Sviatoslav Moskalev, Joshua Nabatian, Bharat Pardasani, Dror Parnes, Jayesh Patel, Langston Payne, David Piccardi, Yong-Xuan Qiu, Justin Rapp, Ravinder Rayu, Roberto Rivalta, Jamie Adler Rodriguez, Bas Röling, Yashwant Sankpal, Roderik Schlösser, Jason Scott, Hanan Shahaf, Yaffa Shalit, Benny Sharvit, Teslim K. Shitta-Bey, Dmitry Shklovsky, Wayne Smith, José Arnaldo Ribeiro Soares, Nagaratnam Sreedharan, Yossi Steinblatt, Nathaniel V. Stevens, Lisa Sun, Maurry Tamarkin, Zoltan Till, Masahiro Tokoro, Efrat Tolkowsky, Jake Vachal, Rafael Paschoarelli Veiga, Shally Venugopal, Torben Voetmann, Simon Wang, Michael Wassermann, James L. Williams, Jared Work, Mark Yoffe, Jumana Zahalka, Aziza Zakhidova, Fan Zhang.

Finally, our thanks go to the many people at Oxford University Press who saw the Third Edition through to completion, beginning with Editorial Director Patrick Lynch, Senior Editor Ann West, Senior Production Manager Micheline Frederick, Editorial Assistants Abigail Roberts and Alison Ball, copyeditor Bob Golden, and proofreader Wesley Morrison.

PART 1

The Time Value of Money

You'll learn in this book that cash flows are evaluated on three important dimensions. The first dimension is simply the sum of money—receiving more money is good and paying more money is bad. The second dimension is called "time value of money"—receiving money tomorrow is not as good as receiving it today. The third dimension is risk—risky cash flow is not as valuable as safe cash flow. You do not need us (or anyone else) to teach you about the first dimension. Part 1 of this book is designed to focus on the second dimension—the time value of money. Throughout this section, we'll assume that the cash flows are not risky or, when comparing cash flows, have the same risk. Chapter 1 presents the basics, Chapter 2 is key since it discusses the techniques of evaluating cash flows in different point of times, Chapter 3 discusses the implementation of the concepts to evaluate investment opportunities, Chapter 4 extends the understanding to analyzing loans, Chapter 5 teaches the proper way to analyze discount rates and infer the correct effective rate, and the final chapter in this part—Chapter 6—provides a comprehensive overview on calculating cash flow in reality.

In some curriculums, this material is called Finance Under Certainty. After reading the chapters in this part, you should understand much of the financial world around you and know how to analyze complex financial situations.

Introduction to Finance

1

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1.1 What Is Finance?

Finance is the study of financial decision making. Individuals and companies make financial decisions every day, and it's important to make them wisely. *Principles of Finance with Excel* discusses how to make these decisions. The book covers the theory and the implementation of wise financial decision making and how to express your decisions using Excel.

Learning to do finance with Excel serves two purposes: It teaches you an important academic and practical subject (finance), and it teaches you how to implement financial analysis using the most important tool (in most cases, the *only* tool) for financial analysis (Excel).

Individual Financial Decision Making

People are constantly called on to make financial decisions in their personal lives. Here are examples of decisions we will examine in this book:

- How much should you save to attain a specific goal in the future? For example: You're starting a savings plan today to save for your college education. How much should you put away each month in order for you to have the money to pay for your education?
- You're thinking about buying a house and renting it out for the income. How should you evaluate this decision?

- You have some money saved from working, and you'd like to invest it. How should you choose your financial portfolio? Investors big and small have to decide whether to invest in stocks, bonds, or other assets such as real estate, art, and gold. They also have to decide how to choose the *investment proportions*: What percentage of your financial portfolio should you invest in stocks (and what percentage in *which* stocks), what percentage in bonds, what percentage in real estate, and so on.
- How should you finance a purchase, a project, or some other undertaking? Here are some examples: You're about to buy a new car. Should you borrow the money from the bank, or should you accept the car dealer's "zero interest loan" alternative? That piece of real estate you're buying—should you finance it with a mortgage? If so, how large should the mortgage be?
- What is financial risk, and how can it be measured? Financial risk can be measured using statistical tools. This book will show you which tools you need and how to apply them. When you're comfortable applying these tools, you will be better able to compare the riskiness of two assets or two investments. Comparing risks is critical to making optimal financial decisions.
- What is the fair value for stocks and bonds and other financial assets? This book will show you how to compute the value of stocks and bonds. It will also discuss the role of financial markets in incorporating available financial information into prices. If financial markets do this well, you may not need to determine these values yourself: You can let the financial markets tell you what the value should be.
- How can you value options? Options are securities which give you the right to buy a stock in the future. If you work in a corporate environment, your employers are likely, at some point, to offer you some options on the company's stock instead of a regular salary. If you're trying to regulate the risk of your financial portfolio, your investment advisor may try to sell you some options. In this book, you'll learn what an option is, how to use it to regulate financial risk, and how to value it.

As these examples show, the study of finance can benefit you in many areas of your personal life by enabling you to make better financial decisions.

Financial Decisions in a Business Environment

You only have to turn on the TV, log onto the Internet, or read a newspaper to hear about the financial decisions made every day by businesses. Some of these financial decisions are huge and dramatic, like Comcast's failed 2015 bid to purchase Time Warner Cable for $45.2 billiion; some are smaller but nonetheless very important for the company, involving things like purchasing new equipment or building a new warehouse or distribution center.

Dramatic business decisions like mergers and acquisitions make the news, but "run-of-the-mill" business financial decisions that are critical to the financial

health of the firm are made by all businesses, big or small. Here are some typical decisions that businesses make:

- A company wants to replace its current production line with a line of new, improved machines. The new machines cost more but are more efficient. Should the company buy the new machines or leave the old ones in place?
- A firm needs custom software to increase productivity. Should it buy off-the-shelf software and develop their own workarounds, or should they invest in a fully customized solution and platform that will be compatible with all their business needs?
- When a company wants to develop and produce a new product, how can it integrate the marketing forecasts for the new product with the financial requirements of the development and production processes? How can the company deal with the fact that the biggest costs of development and production will be incurred before any revenues have been realized from the sale of the product?
- How should the financial officers of a corporation plan for a new or existing business? A *financial planning model* can provide a systematic approach to making many of the financial decisions in a new or existing business. Perhaps you're thinking of setting up a laundromat on the corner of Main and Pine Streets. Perhaps you're starting a real estate business. Or perhaps you're trying to finance a new high-tech idea. In each case, your ability to get financing from financial institutions—whether banks or venture capital funds or your Uncle Joe—will depend on your ability to make a financial model for the new business. This financial model will show your thoughts about how the business will develop, how much equipment you'll need to purchase, and how you will finance sales. Most importantly, the financial model will project future earnings from the business.
- All companies must decide how to finance their activities. This is true for multi-national conglomerates, mom-and-pop convenience stores, and the new taxi company you're about to start with your cousin Sarah. In all cases, someone has to decide whether to borrow the money from others or whether to use shareholder funds (equity, in the terminology of finance) to finance the company.

Wealth Maximization and Risk

This book is primarily about making *sensible financial decisions*. Sometimes a sensible financial decision is also an *optimal* financial decision. Optimal financial decisions make you better off than all the other relevant alternatives, including doing nothing at all. Economists call this property of optimal financial decisions *wealth maximization*. Not every case of money management boils down to making

a wealth-maximizing decision; sometimes we will be able to only point to a *sensible set of financial alternatives* from which you can choose a final decision.

Making sensible or wealth-maximizing financial decisions always involves two elements.

- **Defining the parameters of the decision**: Financial decisions can always be defined in terms of numbers. The outcomes of a financial decision almost always depend on the *decision parameters*, the inputs which define the results of the financial decision.

Here's an example: You've been given $100 for your birthday, and you decide to save it toward your summer vacation next year. You have two choices: You can leave the money in your checking account, or you can put the money in a savings account. The two parameters of this decision are the amount you're saving ($100) and the interest paid on the account—the checking account pays 1% interest, whereas the savings account pays 4% interest. The *financial outcomes* are that 1 year from now, you will have $101 if you leave the money in your checking account and $104 if you put the money in a savings account. This decision is, of course, a no-brainer: You always prefer earning 4% to earning 1% on your money.[1]

This book will help you distinguish between the parameters of financial decisions and the outcomes of financial decisions.

- **Recognizing the risks of financial decisions**: Financial decisions should be made within a framework that takes into account the risks associated with them.

Let's go back to the $100 you intend to save for your summer vacation. In addition to the two alternatives (1% on your checking account and 4% on your savings account), your Uncle Joe suggests that you might want to buy shares in his new hot dog stand. Investors in Joe's previous hot dog stands have earned as much as 40% on their investment.

If you put your money in Uncle Joe's hot dog stand, you *might* have $140 at the end of the year, instead of $104, but if the hot dog stand does poorly, you could lose your $100 investment and end up with nothing. Uncle Joe's hot dog stand is *much more risky* than a bank account—although some investors have made as much as 40%, others have lost all their money with Joe. Comparing an investment in the hot dog stand with a deposit in a savings account must take into account the differences in their risks. This book will show you how to account for risks inherent in making financial decisions.

[1] Of course there may be other things going on: Checking account balances are always available, whereas perhaps the balance in your savings account needs to be there for some minimum period of time before you earn the interest.

IT'S OFFICIAL: Intel is buying the autonomous-driving company Mobileye for $15.3 billion

Portia Crowe
Business Insider March 13, 2017

A device, part of the Mobileye driving assist system, is seen on the dashboard of a vehicle during a demonstration for the media in Jerusalem October 24, 2012. REUTERS/Baz Ratner

(Mobileye technology.Thomson Reuters)

Intel is buying the Israeli autonomous-driving company Mobileye for $63.54 a share in cash, or about $15.3 billion.

Mobileye soared about 30% in premarket trading Monday after the Israeli newspaper Haaretz broke the news.

The Jerusalem-based company develops vision-based driver-assistance tools to provide warnings before collisions.

"Mobileye brings the industry's best automotive-grade computer vision and strong momentum with automakers and suppliers," Intel CEO Brian Krzanich said in a statement.

"Together, we can accelerate the future of autonomous driving with improved performance in a cloud-to-car solution at a lower cost for automakers."

Tesla began incorporating Mobileye's technology into Model S cars in 2015.

In January, it announced it was developing a test fleet of autonomous cars together with BMW and Intel.

Mobileye was cofounded in 1999 by Amnon Shashua, an academic, and Ziv Aviram, who is the CEO. Goldman Sachs and Morgan Stanley took it public in 2014.

Source: https://finance.yahoo.com/news/mobileyes-stock-soaring-report-intel-101337297.html

1.2 Microsoft Excel: Why This Book and Not Another?

There are dozens of introductory finance texts out there. Many of them are very good. So why this one? In a word: **Excel**. Finance is the study of financial decision making and is therefore inherently a topic requiring lots of computation. In this book, the computation is done in, and illustrated with, Excel, the premier

business computational tool. Excel gives you the flexibility to change the elements of an example and to immediately get a new answer. We will use this flexibility extensively throughout *Principles of Finance with Excel*.

Finance is a very practical discipline. Most of you are studying finance not only to increase your understanding of the valuation process, but also to *get answers to practical problems*. You will find that the extensive computation required in this book will not just enable you to get numerical answers to important problems (though that alone would justify the Excel-centered focus of this book)—it will also deepen your understanding of the concepts involved.

Using Excel enables us to discuss many more real-life examples than is possible by using a calculator. Your knowledge of both finance and Excel will be enhanced by carefully working through the examples and exercises in each chapter.[2]

Most college students will be coming to a finance course after having taken an initial computing course which covers the basics of Excel used in this book. If you want an Excel review, the last six chapters of this book cover the essential Excel concepts that are used in this book. In addition, throughout the book you will find explanations of Excel functions and their application to financial problems. When things get really rough, you'll find little boxes called "Excel notes" which explain difficult concepts. Here is an example of such a box:

EXCEL NOTE

Using Sum to Compute Profit and Loss

The Excel function **Sum** can often be used to simplify calculations. Here's an example based on the computation of a profit and loss statement:

	A	B	C
1	**USING SUM TO COMPUTE THE PROFIT AND LOSS**		
2	Profit and loss		
3	Sales	1,000	
4	Cost of goods sold	–500	
5	Depreciation	–100	
6	Interest	–35	
7	Profit before taxes	365	<– =SUM(B3:B6)
8	Taxes (40%)	–146	<– =–40%*B7
9	Profit after taxes	219	<– =SUM(B7:B8)

Cells B7 and B9 use the **Sum** function to add multiple cells. An alternative to using **Sum** in cell B7 would be to use the formula **=B3+B4+B5+B6**. As you can see, **Sum** is more concise.

[2] If you're a finance student at a college or university, this combination of Excel and finance will also enhance your employment opportunities. Excel is practically the only financial tool used by business today.

Excel Versions

Principles of Finance with Excel illustrates all its examples using Excel 2016 for Windows, the spreadsheets are fully compatible with earlier versions of Excel.

What Are the Excel Prerequisites for This Book?

You do not have to be an Excel expert to use this book. Almost all the Excel concepts needed to do finance are explained in the text itself. While this book will teach you the Excel concepts needed for finance, it is not a complete Excel text. Before you start Chapter 2, you should know how to do the following in Excel (all are covered in Chapter 24):

- Open and save an Excel notebook.
- **Format numbers:** You can make numbers appear in different forms. In the example below, the number 2,313.88 is shown in three different ways. You should know how to do this formatting. In this case, we've chosen an appropriate format from the drop-down list on the **Format** section of the **Home** tab of Excel and indicated the appropriate formatting.