Mastering Corporate Finance Essentials

The Critical Quantitative Methods and Tools in Finance

STUART A. MCCRARY
Founded in 1807, John Wiley & Sons is the oldest independent publishing company in the United States. With offices in North America, Europe, Australia, and Asia, Wiley is globally committed to developing and marketing print and electronic products and services for our customers’ professional and personal knowledge and understanding.

The Wiley Finance series contains books written specifically for finance and investment professionals as well as sophisticated individual investors and their financial advisors. Book topics range from portfolio management to e-commerce, risk management, financial engineering, valuation and financial instrument analysis, and much more.

For a list of available titles, please visit our Web site at www.WileyFinance.com.
To my loving wife, Nancy
# Contents

<table>
<thead>
<tr>
<th>Preface</th>
<th>xi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgments</td>
<td>xiii</td>
</tr>
</tbody>
</table>

## CHAPTER 1

### Time Value of Money Toolbox

| Introduction | 1 |
| Cash Flows | 1 |
| Future Value | 2 |
| The Impact of Compounding Frequency on Future Value | 8 |
| Equivalent Interest Rate | 9 |
| Continuously Compounded Interest | 11 |
| Present Value | 12 |
| Formulas for Present Value and Future Value | 14 |
| Conclusion | 17 |
| Questions | 18 |

## CHAPTER 2

### Statistics for Finance

| Introduction | 19 |
| The Meaning of Mean or Average | 19 |
| Median as a Substitute for Mean | 20 |
| Standard Deviation Measures the Noise | 20 |
| Annualizing Variance and Standard Deviation Estimates | 27 |
| The Normal Curve Is a Probability Distribution | 29 |
| The Cumulative Density Function | 31 |
| Measures of Dependency | 32 |
| Measuring Covariance and Correlation | 36 |
| Calculating Statistics in Practice | 37 |
| Combining Normal Distributions | 37 |
| Conclusion | 42 |
| Questions | 43 |
CHAPTER 3  
Core Finance Theories and the Cost of Capital  
Introduction  
Risk Reduction from Diversification  
Systematic versus Unsystematic Risk  
The Market Portfolio  
The Capital Asset Pricing Model  
Using Beta to Determine the Required Return for a Stock  
Other Factor Models  
Cost of Debt  
Weighted Average Cost of Capital  
Modigliani and Miller  
Patterns of Debt and Equity in Capital Structures  
Conclusion  
Questions  

CHAPTER 4  
Capital Budgeting Tools  
Introduction  
Three Ways to Evaluate Investments  
Calculating Net Present Value  
Net Present Value Example  
Calculating Internal Rate of Return  
Calculating Years to Payback  
Financial Decision Making  
The Annuity Formula  
Valuing an Annuity with More Frequent Cash Flows  
Using the Present Value Formula and the Annuity Formula to Value a Bond  
Using the Annuity Formula to Value a Mortgage  
NPV Using the Annuity Formula  
Valuing a Perpetuity  
Valuing a Growth Perpetuity  
Introduction to Uncertainty  
Conclusion  
Questions  

CHAPTER 5  
Techniques for Handling Uncertainty  
Introduction  
Using Scenario Analysis
Contents

Using Monte Carlo Simulation 79
Uniform Random Numbers 83
Transforming Uniform Distributions 83
Adding and Multiplying Two Random Numbers 91
Using Random Numbers in Budget Analysis 92
Using Random Numbers in a Capital Budgeting Analysis 94
Conclusion 96
Questions 97

CHAPTER 6
Real Option Analysis of Capital Investments 99

Introduction 99
Why Study Options? 100
What Is a Real Option? 101
Types of Real Options 102
Methods for Valuing Real Options 105
Conclusion 117
Questions 118

APPENDIX:
Day Counting for Interest Rate Calculations 119

Introduction 119
The 30/360 Method 120
The Actual/Actual Method 121
The Actual/360 Method 121
The Actual/365 Method 122
Example and Comparison of 30/360 and Actual/Actual 122
Impact of Day Counting over Longer Intervals 123
Calculating Calendar Intervals over Long Periods 123
A Note about Continuous Compounding 124
Conclusion 125

Questions and Answers 127
About the Author 167
Index 169
Preface

Mastering Corporate Finance Essentials is directed to corporate managers who work with their companies’ finance departments and need to understand their work, priorities, and methods. Since corporate finance is at the heart of many key issues, from performance evaluation to project funding, corporate managers must be able to discuss, assess, and contribute to the financial decision-making process to be successful.

The book is written as a text for an executive masters program in business school or as part of the business curriculum in a professional degree program (engineering, law, medicine, etc.). To respect the scarce time of the student, the most important material occupies the main text. Numerous stand-alone inserts, mostly in the detailed answers to review questions, dig into topics more deeply and may present some topics that are more quantitative. Although this text is designed as a concise book covering just the essentials, these inserts devote considerable attention to “quantitative finance,” including alternatives to discounted cash flow analysis.

The text is designed to permit the reader to quickly learn present value techniques in Chapter 1. Chapter 2 includes a review of statistics used in corporate finance. Chapter 3 summarizes the most important lessons in corporate finance. Chapter 4 synthesizes material in each earlier chapter to apply it to valuing projects and making investment decisions. Chapter 5 introduces additional tools to evaluate risk. Finally, Chapter 6 extends traditional financial tools to value risk and opportunities.

Each chapter builds a foundation for later chapters. The book ends with important topics in quantitative finance. However, readers can focus on traditional corporate finance and skip the later chapters.

Review questions follow each chapter. The book includes detailed answers to review questions that explore topics in greater depth. A short course can focus on the essential topics presented in the chapters. Instructors with more time can include the questions and answers to present practical, hands-on details. The detailed questions and answers work well for self-study.

This book is quantitative, because the field of finance is quantitative. Difficult topics are explained in clear and simple language. Numerous
examples demonstrate how to perform each analysis and assist the reader to understand the material. The text also offers advice on how to use Excel for financial analysis.

A companion text on financial accounting, called *Mastering Financial Accounting Essentials*, presents key accounting concepts in a similarly condensed format. This book focuses on understanding accounting as a reader of financial statements or as a business manager. *Mastering Financial Accounting Essentials* is a great book to use to round out your understanding of business financial results.

Stuart A. McCrary
August 2009
I would like to thank the many people at Chicago Partners LLC (a division of Navigant Consulting, Inc.) for their advice on presenting this corporate finance curriculum simply. In addition, I thank Paula Mikrut for making a careful reading of the text.

I also want to thank my students and the administration of Northwestern University, especially program directors Walter B. Herbst and Richard M. Lueptow. This book reflects my efforts to create an executive masters curriculum that covers topics in corporate finance in an incredibly short period. The class reflects our mutual efforts to present advanced financial information to nonfinance professionals so that these students can become more effective business leaders.
INTRODUCTION

One of the most important tools used in corporate finance is present value mathematics. These techniques are used to evaluate projects, make financial decisions, and evaluate investments. This chapter explains the time value of money, including present value (PV) and future value (FV), and how to adjust valuation formulas for various interest rate conventions. The chapter also presents several shortcuts to value a series of cash flows that fit a few standard patterns.

Readers should begin by developing an intuitive understanding of why it is necessary to incorporate interest rates into any analysis involving different periods of time. This understanding leads to a simple set of formulas expressing several time value relationships. After developing an intuitive understanding, readers will find it easy to incorporate interest rates by using the formulas for present value and/or future value in their analyses. Although this analysis shows up quite often, students will be relieved to find that its application is similar in most instances.

CASH FLOWS

Much of this text focuses on cash flows. Accountants realize the importance of cash; they devote an entire statement to the analysis of the sources and the uses of cash and cash balances. Accountants are interested in tracking cash flow in large measure because a company must have adequate cash to survive and prosper. Start-up companies may run out of cash before they have a chance to establish their businesses. Even established companies focus on both the profitability of the business and the flow of cash.

Corporate finance uses the same or similar measure of cash flow as accountants track in the statement of cash flows. However, this chapter and
much of this book rely on cash flows for a completely different analysis and treat the cash flows from a project or even the cash flows of an entire corporation much like the cash flows of a bond. With a bond, investors transfer money today to borrowers, who in turn pay interest and eventually repay the loan. The size and timing of the cash payments and cash receipts determines the attractiveness of the bond investment. The techniques described herein will enable investors to evaluate the cash flows of any investment regardless of when the cash flows occur.

FUTURE VALUE

The future value of a cash flow is the value at some specified future time of a cash flow that occurs immediately. The concept of future value allows a company to decide whether cash flows that occur at two different times are equivalent. The way in which the two cash flows are equivalent is the subject of this chapter and will be explained subsequently.

Suppose that a company issues a bill that requires a customer to pay $100 upon receipt. The customer asks for extra time to pay. The company can borrow at an 8 percent interest rate. The company tells the customer that it will accept $102 instead in three months.

The company calculated the amount of cash it would accept that would be equivalent to getting $100 immediately. If the delay in receiving payment causes the company to borrow $100 for three months, the company must account for the interest on the loan. The formula for interest might look like Equation 1.1.

\[
\text{Interest} = \frac{\text{Principal}}{\text{Rate}} \times \text{Time} = \frac{100}{8\%} \times 3/12 = 2
\]

This is a formula for simple interest. Simple interest applies the interest rate to a principal balance for a period of time. The formula begins with the principal balance multiplied by the annual interest rate of 8 percent or $8. However, the rate applies only to three months or one-quarter of the year. Therefore, the interest for three months is $2, and the amount of the delayed payment would have to be $100 + 2 = $102 to compensate the company for the delay in payment.

The immediate payment of $100 in the preceding example is called the present value. The later payment is called a future value. As has been demonstrated, the two amounts are linked by the interest rate and the amount of time between the two payment dates.

In the preceding example, an 8 percent interest rate was used to determine an equivalent future payment from a present value. The method relied
on a bank rate of interest. In fact, the company may still prefer the immediate payment of $100 to a deferred payment of $102. The deferred payment exposes the company to the risk of nonpayment for a longer period of time. The delay increases the amount the company must record as an account receivable in its financial statements and requires the company to include a liability on the balance sheet for the bank loan.

To address these concerns, the company may increase the interest rate used in determining the future value it will accept in lieu of the immediate payment of $100. Later, this text will explore factors that affect the interest rate or return that links present values to future values. This chapter, however, generally assumes that the company knows the required rate that incorporates these factors.

A more general formula for interest appears in Equation 1.2.

\[
\text{Interest} = \frac{\text{Present Value}}{\text{Rate}} \times \text{Time}
\]  

(1.2)

where Time is the interval in years between the time of the present value and the time of the future value and Rate is the annual interest rate.

The value of a cash payment that occurs immediately is the present value. The future value of this cash flow is the present value plus interest, as set forth in Equation 1.3.

\[
\text{Future Value} = \text{Present Value} + \text{Interest}
\]  

(1.3)

Substitute the formula for interest in Equation 1.2 into the formula for future value in Equation 1.3 to produce Equation 1.4.

\[
\text{Future Value} = \text{Present Value} + \frac{\text{Present Value}}{\text{Rate}} \times \text{Time}
\]  

(1.4)

Finally, simplify Equation 1.4 by collecting terms. The result is Equation 1.5, which shows that the future value is related to the present value by a rate of interest that applies to the time from the present payments to the future payments.

\[
\text{Future Value} = \text{Present Value} \times (1 + \text{Rate} \times \text{Time})
\]  

(1.5)

**Compound Interest**

The formula for future value in Equation 1.5 is correct for short intervals of time, but most investments pay interest every three months, every six months, or annually. When investments pay interest between the time of the present value and the time of the future value, the formula in Equation 1.5