



# CORPORATE FINANCE

CFA® Program Curriculum  
**2020 • LEVEL II • VOLUME 3**

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# How to Use the CFA Program Curriculum

Congratulations on reaching Level II of the Chartered Financial Analyst® (CFA®) Program. This exciting and rewarding program of study reflects your desire to become a serious investment professional. You have embarked on a program noted for its high ethical standards and the breadth of knowledge, skills, and abilities (competencies) it develops. Your commitment to the CFA Program should be educationally and professionally rewarding.

The credential you seek is respected around the world as a mark of accomplishment and dedication. Each level of the program represents a distinct achievement in professional development. Successful completion of the program is rewarded with membership in a prestigious global community of investment professionals. CFA charterholders are dedicated to life-long learning and maintaining currency with the ever-changing dynamics of a challenging profession. The CFA Program represents the first step toward a career-long commitment to professional education.

The CFA examination measures your mastery of the core knowledge, skills, and abilities required to succeed as an investment professional. These core competencies are the basis for the Candidate Body of Knowledge (CBOK™). The CBOK consists of four components:

- A broad outline that lists the major topic areas covered in the CFA Program (<https://www.cfainstitute.org/programs/cfa/curriculum/cbok>);
- Topic area weights that indicate the relative exam weightings of the top-level topic areas (<https://www.cfainstitute.org/programs/cfa/curriculum/overview>);
- Learning outcome statements (LOS) that advise candidates about the specific knowledge, skills, and abilities they should acquire from readings covering a topic area (LOS are provided in candidate study sessions and at the beginning of each reading); and
- The CFA Program curriculum that candidates receive upon examination registration.

Therefore, the key to your success on the CFA examinations is studying and understanding the CBOK. The following sections provide background on the CBOK, the organization of the curriculum, features of the curriculum, and tips for designing an effective personal study program.

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## BACKGROUND ON THE CBOK

The CFA Program is grounded in the practice of the investment profession. Beginning with the Global Body of Investment Knowledge (GBIK), CFA Institute performs a continuous practice analysis with investment professionals around the world to determine the competencies that are relevant to the profession. Regional expert panels and targeted surveys are conducted annually to verify and reinforce the continuous feedback about the GBIK. The practice analysis process ultimately defines the CBOK. The

CBOK reflects the competencies that are generally accepted and applied by investment professionals. These competencies are used in practice in a generalist context and are expected to be demonstrated by a recently qualified CFA charterholder.

The CFA Institute staff, in conjunction with the Education Advisory Committee and Curriculum Level Advisors that consist of practicing CFA charterholders, designs the CFA Program curriculum in order to deliver the CBOK to candidates. The examinations, also written by CFA charterholders, are designed to allow you to demonstrate your mastery of the CBOK as set forth in the CFA Program curriculum. As you structure your personal study program, you should emphasize mastery of the CBOK and the practical application of that knowledge. For more information on the practice analysis, CBOK, and development of the CFA Program curriculum, please visit [www.cfainstitute.org](http://www.cfainstitute.org).

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## ORGANIZATION OF THE CURRICULUM

The Level II CFA Program curriculum is organized into 10 topic areas. Each topic area begins with a brief statement of the material and the depth of knowledge expected. It is then divided into one or more study sessions. These study sessions—17 sessions in the Level II curriculum—should form the basic structure of your reading and preparation. Each study session includes a statement of its structure and objective and is further divided into assigned readings. An outline illustrating the organization of these 17 study sessions can be found at the front of each volume of the curriculum.

The readings are commissioned by CFA Institute and written by content experts, including investment professionals and university professors. Each reading includes LOS and the core material to be studied, often a combination of text, exhibits, and in-text examples and questions. A reading typically ends with practice problems followed by solutions to these problems to help you understand and master the material. The LOS indicate what you should be able to accomplish after studying the material. The LOS, the core material, and the practice problems are dependent on each other, with the core material and the practice problems providing context for understanding the scope of the LOS and enabling you to apply a principle or concept in a variety of scenarios.

*The entire readings, including the practice problems at the end of the readings, are the basis for all examination questions and are selected or developed specifically to teach the knowledge, skills, and abilities reflected in the CBOK.*

You should use the LOS to guide and focus your study because each examination question is based on one or more LOS and the core material and practice problems associated with the LOS. As a candidate, you are responsible for the entirety of the required material in a study session.

We encourage you to review the information about the LOS on our website ([www.cfainstitute.org/programs/cfa/curriculum/study-sessions](http://www.cfainstitute.org/programs/cfa/curriculum/study-sessions)), including the descriptions of LOS “command words” on the candidate resources page at [www.cfainstitute.org](http://www.cfainstitute.org).

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## FEATURES OF THE CURRICULUM

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### OPTIONAL SEGMENT

**Required vs. Optional Segments** You should read all of an assigned reading. In some cases, though, we have reprinted an entire publication and marked certain parts of the reading as “optional.” The CFA examination is based only on the required segments, and the optional segments are included only when it is determined that they might

help you to better understand the required segments (by seeing the required material in its full context). When an optional segment begins, you will see an icon and a dashed vertical bar in the outside margin that will continue until the optional segment ends, accompanied by another icon. *Unless the material is specifically marked as optional, you should assume it is required.* You should rely on the required segments and the reading-specific LOS in preparing for the examination.

END OPTIONAL  
SEGMENT

**Practice Problems/Solutions** *All practice problems at the end of the readings as well as their solutions are part of the curriculum and are required material for the examination.* In addition to the in-text examples and questions, these practice problems should help demonstrate practical applications and reinforce your understanding of the concepts presented. Some of these practice problems are adapted from past CFA examinations and/or may serve as a basis for examination questions.

**Glossary** For your convenience, each volume includes a comprehensive glossary. Throughout the curriculum, a **bolded** word in a reading denotes a term defined in the glossary.

Note that the digital curriculum that is included in your examination registration fee is searchable for key words, including glossary terms.

**LOS Self-Check** We have inserted checkboxes next to each LOS that you can use to track your progress in mastering the concepts in each reading.

**Source Material** The CFA Institute curriculum cites textbooks, journal articles, and other publications that provide additional context and information about topics covered in the readings. As a candidate, you are not responsible for familiarity with the original source materials cited in the curriculum.

Note that some readings may contain a web address or URL. The referenced sites were live at the time the reading was written or updated but may have been deactivated since then.



Some readings in the curriculum cite articles published in the *Financial Analysts Journal*®, which is the flagship publication of CFA Institute. Since its launch in 1945, the *Financial Analysts Journal* has established itself as the leading practitioner-oriented journal in the investment management community. Over the years, it has advanced the knowledge and understanding of the practice of investment management through the publication of peer-reviewed practitioner-relevant research from leading academics and practitioners. It has also featured thought-provoking opinion pieces that advance the common level of discourse within the investment management profession. Some of the most influential research in the area of investment management has appeared in the pages of the *Financial Analysts Journal*, and several Nobel laureates have contributed articles.

Candidates are not responsible for familiarity with *Financial Analysts Journal* articles that are cited in the curriculum. But, as your time and studies allow, we strongly encourage you to begin supplementing your understanding of key investment management issues by reading this practice-oriented publication. Candidates have full online access to the *Financial Analysts Journal* and associated resources. All you need is to log in on [www.cfapubs.org](http://www.cfapubs.org) using your candidate credentials.

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**Errata** The curriculum development process is rigorous and includes multiple rounds of reviews by content experts. Despite our efforts to produce a curriculum that is free of errors, there are times when we must make corrections. Curriculum errata are periodically updated and posted on the candidate resources page at [www.cfainstitute.org](http://www.cfainstitute.org).

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## DESIGNING YOUR PERSONAL STUDY PROGRAM

**Create a Schedule** An orderly, systematic approach to examination preparation is critical. You should dedicate a consistent block of time every week to reading and studying. Complete all assigned readings and the associated problems and solutions in each study session. Review the LOS both before and after you study each reading to ensure that you have mastered the applicable content and can demonstrate the knowledge, skills, and abilities described by the LOS and the assigned reading. Use the LOS self-check to track your progress and highlight areas of weakness for later review.

Successful candidates report an average of more than 300 hours preparing for each examination. Your preparation time will vary based on your prior education and experience, and you will probably spend more time on some study sessions than on others. As the Level II curriculum includes 17 study sessions, a good plan is to devote 15–20 hours per week for 17 weeks to studying the material and use the final four to six weeks before the examination to review what you have learned and practice with practice questions and mock examinations. This recommendation, however, may underestimate the hours needed for appropriate examination preparation depending on your individual circumstances, relevant experience, and academic background. You will undoubtedly adjust your study time to conform to your own strengths and weaknesses and to your educational and professional background.

You should allow ample time for both in-depth study of all topic areas and additional concentration on those topic areas for which you feel the least prepared.

As part of the supplemental study tools that are included in your examination registration fee, you have access to a study planner to help you plan your study time. The study planner calculates your study progress and pace based on the time remaining until examination. For more information on the study planner and other supplemental study tools, please visit [www.cfainstitute.org](http://www.cfainstitute.org).

As you prepare for your examination, we will e-mail you important examination updates, testing policies, and study tips. Be sure to read these carefully.

**CFA Institute Practice Questions** Your examination registration fee includes digital access to hundreds of practice questions that are additional to the practice problems at the end of the readings. These practice questions are intended to help you assess your mastery of individual topic areas as you progress through your studies. After each practice question, you will be able to receive immediate feedback noting the correct responses and indicating the relevant assigned reading so you can identify areas of weakness for further study. For more information on the practice questions, please visit [www.cfainstitute.org](http://www.cfainstitute.org).

**CFA Institute Mock Examinations** Your examination registration fee also includes digital access to three-hour mock examinations that simulate the morning and afternoon sessions of the actual CFA examination. These mock examinations are intended to be taken after you complete your study of the full curriculum and take practice questions so you can test your understanding of the curriculum and your readiness for the examination. You will receive feedback at the end of the mock examination, noting the correct responses and indicating the relevant assigned readings so you can assess areas of weakness for further study during your review period. We recommend that you take mock examinations during the final stages of your preparation for the actual CFA examination. For more information on the mock examinations, please visit [www.cfainstitute.org](http://www.cfainstitute.org).

**Preparatory Providers** After you enroll in the CFA Program, you may receive numerous solicitations for preparatory courses and review materials. When considering a preparatory course, make sure the provider belongs to the CFA Institute Approved Prep Provider Program. Approved Prep Providers have committed to follow CFA Institute guidelines and high standards in their offerings and communications with candidates. For more information on the Approved Prep Providers, please visit [www.cfainstitute.org/programs/cfa/exam/prep-providers](http://www.cfainstitute.org/programs/cfa/exam/prep-providers).

Remember, however, that there are no shortcuts to success on the CFA examinations; reading and studying the CFA curriculum *is* the key to success on the examination. The CFA examinations reference only the CFA Institute assigned curriculum—no preparatory course or review course materials are consulted or referenced.

## SUMMARY

Every question on the CFA examination is based on the content contained in the required readings and on one or more LOS. Frequently, an examination question is based on a specific example highlighted within a reading or on a specific practice problem and its solution. To make effective use of the CFA Program curriculum, please remember these key points:

- 1 All pages of the curriculum are required reading for the examination except for occasional sections marked as optional. You may read optional pages as background, but you will not be tested on them.
- 2 All questions, problems, and their solutions—found at the end of readings—are part of the curriculum and are required study material for the examination.
- 3 You should make appropriate use of the practice questions and mock examinations as well as other supplemental study tools and candidate resources available at [www.cfainstitute.org](http://www.cfainstitute.org).
- 4 Create a schedule and commit sufficient study time to cover the 17 study sessions using the study planner. You should also plan to review the materials and take topic tests and mock examinations.
- 5 Some of the concepts in the study sessions may be superseded by updated rulings and/or pronouncements issued after a reading was published. Candidates are expected to be familiar with the overall analytical framework contained in the assigned readings. Candidates are not responsible for changes that occur after the material was written.

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## FEEDBACK

At CFA Institute, we are committed to delivering a comprehensive and rigorous curriculum for the development of competent, ethically grounded investment professionals. We rely on candidate and investment professional comments and feedback as we work to improve the curriculum, supplemental study tools, and candidate resources.

Please send any comments or feedback to [info@cfainstitute.org](mailto:info@cfainstitute.org). You can be assured that we will review your suggestions carefully. Ongoing improvements in the curriculum will help you prepare for success on the upcoming examinations and for a lifetime of learning as a serious investment professional.



# Corporate Finance

## STUDY SESSIONS

<b>Study Session 7</b>	Corporate Finance (1)
<b>Study Session 8</b>	Corporate Finance (2)

## TOPIC LEVEL LEARNING OUTCOME

The candidate should be able to evaluate capital budget projects, capital structure policy, dividend policy, corporate governance, and mergers and acquisitions.

Capital investments, corporate structure, payout policies, governance, mergers, and acquisitions can significantly affect a company's operations, financials, and performance. Companies having strong leadership, well managed operations, sound corporate governance policies, and profitable investment activities are more likely to add value for their shareholders and other stakeholders.



## CORPORATE FINANCE STUDY SESSION

# 7

## Corporate Finance (1)

This study session covers the capital budgeting process with emphasis on its principles and investment decision criteria. Project evaluation through the use of spreadsheet modeling is presented. Other income and valuation model approaches are compared. The subject of capital structure is introduced with the classic Modigliani–Miller irrelevance theory, which proposes that capital structure decisions should have no effect on company value. Additional considerations of taxes, agency costs, and financial distress are introduced. The session concludes with discussion on dividend policies, factors affecting distribution or reinvestment, and dividend payout or share repurchase decisions.

### READING ASSIGNMENTS

<b>Reading 19</b>	Capital Budgeting by John D. Stowe, PhD, CFA, and Jacques R. Gagné, FSA, CFA, CIPM
<b>Reading 20</b>	Capital Structure by Raj Aggarwal, PhD, CFA, Pamela Peterson Drake, PhD, CFA, Adam Kobor, PhD, CFA, and Gregory Noronha, PhD, CFA
<b>Reading 21</b>	Analysis of Dividends and Share Repurchases by Gregory Noronha, PhD, CFA, and George H. Troughton, PhD, CFA



## READING

# 19

## Capital Budgeting

by John D. Stowe, PhD, CFA, and Jacques R. Gagné, FSA, CFA, CIPM

*John D. Stowe, PhD, CFA, is at Ohio University (USA). Jacques R. Gagné, FSA, CFA, CIPM, is at ENAP (Canada).*

### LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. calculate the yearly cash flows of expansion and replacement capital projects and evaluate how the choice of depreciation method affects those cash flows;
<input type="checkbox"/>	b. explain how inflation affects capital budgeting analysis;
<input type="checkbox"/>	c. evaluate capital projects and determine the optimal capital project in situations of 1) mutually exclusive projects with unequal lives, using either the least common multiple of lives approach or the equivalent annual annuity approach, and 2) capital rationing;
<input type="checkbox"/>	d. explain how sensitivity analysis, scenario analysis, and Monte Carlo simulation can be used to assess the stand-alone risk of a capital project;
<input type="checkbox"/>	e. explain and calculate the discount rate, based on market risk methods, to use in valuing a capital project;
<input type="checkbox"/>	f. describe types of real options and evaluate a capital project using real options;
<input type="checkbox"/>	g. describe common capital budgeting pitfalls;
<input type="checkbox"/>	h. calculate and interpret accounting income and economic income in the context of capital budgeting;
<input type="checkbox"/>	i. distinguish among the economic profit, residual income, and claims valuation models for capital budgeting and evaluate a capital project using each.

OPTIONAL  
SEGMENT

# 1

## INTRODUCTION

Capital budgeting is the process that companies use for decision making on capital projects—those projects with a life of a year or more. This is a fundamental area of knowledge for financial analysts for many reasons.

- First, capital budgeting is very important for corporations. Capital projects, which make up the long-term asset portion of the balance sheet, can be so large that sound capital budgeting decisions ultimately decide the future of many corporations. Capital decisions cannot be reversed at a low cost, so mistakes are very costly. Indeed, the real capital investments of a company describe a company better than its working capital or capital structures, which are intangible and tend to be similar for many corporations.
- Second, the principles of capital budgeting have been adapted for many other corporate decisions, such as investments in working capital, leasing, mergers and acquisitions, and bond refunding.
- Third, the valuation principles used in capital budgeting are similar to the valuation principles used in security analysis and portfolio management. Many of the methods used by security analysts and portfolio managers are based on capital budgeting methods. Conversely, there have been innovations in security analysis and portfolio management that have also been adapted to capital budgeting.
- Finally, although analysts have a vantage point outside the company, their interest in valuation coincides with the capital budgeting focus of maximizing shareholder value. Because capital budgeting information is not ordinarily available outside the company, the analyst may attempt to estimate the process, within reason, at least for companies that are not too complex. Further, analysts may be able to appraise the quality of the company's capital budgeting process, for example, on the basis of whether the company has an accounting focus or an economic focus.

This reading is organized as follows: Section 2 presents the steps in a typical capital budgeting process. After introducing the basic principles of capital budgeting in Section 3, in Section 4 we discuss the criteria by which a decision to invest in a project may be made. Section 5 presents a crucial element of the capital budgeting process: organizing the cash flow information that is the raw material of the analysis. Section 6 looks further at cash flow analysis. Section 7 demonstrates methods to extend the basic investment criteria to address economic alternatives and risk. Finally, Section 8 compares other income measures and valuation models that analysts use to the basic capital budgeting model.

# 2

## THE CAPITAL BUDGETING PROCESS

The specific capital budgeting procedures that a manager uses depend on the manager's level in the organization, the size and complexity of the project being evaluated, and the size of the organization. The typical steps in the capital budgeting process are as follows:

- Step One, Generating Ideas—Investment ideas can come from anywhere, from the top or the bottom of the organization, from any department or functional area, or from outside the company. Generating good investment ideas to consider is the most important step in the process.

- Step Two, Analyzing Individual Proposals—This step involves gathering the information to forecast cash flows for each project and then evaluating the project's profitability.
- Step Three, Planning the Capital Budget—The company must organize the profitable proposals into a coordinated whole that fits within the company's overall strategies, and it also must consider the projects' timing. Some projects that look good when considered in isolation may be undesirable strategically. Because of financial and real resource issues, scheduling and prioritizing projects is important.
- Step Four, Monitoring and Post-auditing—In a post-audit, actual results are compared to planned or predicted results, and any differences must be explained. For example, how do the revenues, expenses, and cash flows realized from an investment compare to the predictions? Post-auditing capital projects is important for several reasons. First, it helps monitor the forecasts and analysis that underlie the capital budgeting process. Systematic errors, such as overly optimistic forecasts, become apparent. Second, it helps improve business operations. If sales or costs are out of line, it will focus attention on bringing performance closer to expectations if at all possible. Finally, monitoring and post-auditing recent capital investments will produce concrete ideas for future investments. Managers can decide to invest more heavily in profitable areas and scale down or cancel investments in areas that are disappointing.

Planning for capital investments can be very complex, often involving many persons inside and outside of the company. Information about marketing, science, engineering, regulation, taxation, finance, production, and behavioral issues must be systematically gathered and evaluated. The authority to make capital decisions depends on the size and complexity of the project. Lower-level managers may have discretion to make decisions that involve less than a given amount of money, or that do not exceed a given capital budget. Larger and more complex decisions are reserved for top management, and some are so significant that the company's board of directors ultimately has the decision-making authority.

Like everything else, capital budgeting is a cost-benefit exercise. At the margin, the benefits from the improved decision making should exceed the costs of the capital budgeting efforts.

Companies often put capital budgeting projects into some rough categories for analysis. One such classification would be as follows:

- 1 Replacement projects. These are among the easier capital budgeting decisions. If a piece of equipment breaks down or wears out, whether to replace it may not require careful analysis. If the expenditure is modest and if not investing has significant implications for production, operations, or sales, it would be a waste of resources to overanalyze the decision. Just make the replacement. Other replacement decisions involve replacing existing equipment with newer, more efficient equipment, or perhaps choosing one type of equipment over another. These replacement decisions are often amenable to very detailed analysis, and you might have a lot of confidence in the final decision.
- 2 Expansion projects. Instead of merely maintaining a company's existing business activities, expansion projects increase the size of the business. These expansion decisions may involve more uncertainties than replacement decisions, and these decisions will be more carefully considered.
- 3 New products and services. These investments expose the company to even more uncertainties than expansion projects. These decisions are more complex and will involve more people in the decision-making process.

- 4 Regulatory, safety, and environmental projects. These projects are frequently required by a governmental agency, an insurance company, or some other external party. They may generate no revenue and might not be undertaken by a company maximizing its own private interests. Often, the company will accept the required investment and continue to operate. Occasionally, however, the cost of the regulatory/safety/environmental project is sufficiently high that the company would do better to cease operating altogether or to shut down any part of the business that is related to the project.
- 5 Other. The projects above are all susceptible to capital budgeting analysis, and they can be accepted or rejected using the net present value (NPV) or some other criterion. Some projects escape such analysis. These are either pet projects of someone in the company (such as the CEO buying a new aircraft) or so risky that they are difficult to analyze by the usual methods (such as some research and development decisions).

## 3

## BASIC PRINCIPLES OF CAPITAL BUDGETING

Capital budgeting has a rich history and sometimes employs some pretty sophisticated procedures. Fortunately, capital budgeting relies on just a few basic principles. Capital budgeting usually uses the following assumptions:

- 1 Decisions are based on cash flows. The decisions are not based on accounting concepts, such as net income. Furthermore, intangible costs and benefits are often ignored because, if they are real, they should result in cash flows at some other time.
- 2 Timing of cash flows is crucial. Analysts make an extraordinary effort to detail precisely when cash flows occur.
- 3 Cash flows are based on opportunity costs. What are the incremental cash flows that occur with an investment compared to what they would have been without the investment?
- 4 Cash flows are analyzed on an after-tax basis. Taxes must be fully reflected in all capital budgeting decisions.
- 5 Financing costs are ignored. This may seem unrealistic, but it is not. Most of the time, analysts want to know the after-tax operating cash flows that result from a capital investment. Then, these after-tax cash flows and the investment outlays are discounted at the “required rate of return” to find the net present value (NPV). Financing costs are reflected in the required rate of return. If we included financing costs in the cash flows and in the discount rate, we would be double-counting the financing costs. So even though a project may be financed with some combination of debt and equity, we ignore these costs, focusing on the operating cash flows and capturing the costs of debt (and other capital) in the discount rate.

Capital budgeting cash flows are not accounting net income. Accounting net income is reduced by noncash charges such as accounting depreciation. Furthermore, to reflect the cost of debt financing, interest expenses are also subtracted from accounting net income. (No subtraction is made for the cost of equity financing in arriving at accounting net income.) Accounting net income also differs from economic income, which is the cash inflow plus the change in the market value of the company. Economic income does not subtract the cost of debt financing, and it is based on the changes in the

market value of the company, not changes in its book value (accounting depreciation). We will further consider cash flows, accounting income, economic income, and other income measures at the end of this reading.

In assumption 5 above, we referred to the rate used in discounting the cash flows as the “required rate of return.” The required rate of return is the discount rate that investors should require given the riskiness of the project. This discount rate is frequently called the “opportunity cost of funds” or the “cost of capital.” If the company can invest elsewhere and earn a return of  $r$ , or if the company can repay its sources of capital and save a cost of  $r$ , then  $r$  is the company’s opportunity cost of funds. If the company cannot earn more than its opportunity cost of funds on an investment, it should not undertake that investment. Unless an investment earns more than the cost of funds from its suppliers of capital, the investment should not be undertaken. The cost-of-capital concept is discussed more extensively elsewhere. Regardless of what it is called, an economically sound discount rate is essential for making capital budgeting decisions.

Although the principles of capital budgeting are simple, they are easily confused in practice, leading to unfortunate decisions. Some important capital budgeting concepts that managers find very useful are given below.

- A **sunk cost** is one that has already been incurred. You cannot change a sunk cost. Today’s decisions, on the other hand, should be based on current and future cash flows and should not be affected by prior, or sunk, costs.
- An **opportunity cost** is what a resource is worth in its next-best use. For example, if a company uses some idle property, what should it record as the investment outlay: the purchase price several years ago, the current market value, or nothing? If you replace an old machine with a new one, what is the opportunity cost? If you invest \$10 million, what is the opportunity cost? The answers to these three questions are, respectively: the current market value, the cash flows the old machine would generate, and \$10 million (which you could invest elsewhere).
- An **incremental cash flow** is the cash flow that is realized because of a decision: the cash flow *with* a decision minus the cash flow *without* that decision. If opportunity costs are correctly assessed, the incremental cash flows provide a sound basis for capital budgeting.
- An externality is the effect of an investment on other things besides the investment itself. Frequently, an investment affects the cash flows of other parts of the company, and these externalities can be positive or negative. If possible, these should be part of the investment decision. Sometimes externalities occur outside of the company. An investment might benefit (or harm) other companies or society at large, and yet the company is not compensated for these benefits (or charged for the costs). **Cannibalization** is one externality. Cannibalization occurs when an investment takes customers and sales away from another part of the company.
- Conventional versus nonconventional cash flows—A **conventional cash flow** pattern is one with an initial outflow followed by a series of inflows. In a **non-conventional cash flow** pattern, the initial outflow is not followed by inflows only, but the cash flows can flip from positive to negative again (or even change signs several times). An investment that involved outlays (negative cash flows) for the first couple of years that were then followed by positive cash flows would be considered to have a conventional pattern. If cash flows change signs once, the pattern is conventional. If cash flows change signs two or more times, the pattern is nonconventional.

Several types of project interactions make the incremental cash flow analysis challenging. The following are some of these interactions:

- Independent versus mutually exclusive projects. **Independent projects** are projects whose cash flows are independent of each other. **Mutually exclusive projects** compete directly with each other. For example, if Projects A and B are mutually exclusive, you can choose A or B, but you cannot choose both. Sometimes there are several mutually exclusive projects, and you can choose only one from the group.
- **Project sequencing.** Many projects are sequenced through time, so that investing in a project creates the option to invest in future projects. For example, you might invest in a project today and then in one year invest in a second project if the financial results of the first project or new economic conditions are favorable. If the results of the first project or new economic conditions are not favorable, you do not invest in the second project.
- Unlimited funds versus capital rationing. An **unlimited funds** environment assumes that the company can raise the funds it wants for all profitable projects simply by paying the required rate of return. **Capital rationing** exists when the company has a fixed amount of funds to invest. If the company has more profitable projects than it has funds for, it must allocate the funds to achieve the maximum shareholder value subject to the funding constraints.

## 4

## INVESTMENT DECISION CRITERIA

Analysts use several important criteria to evaluate capital investments. The two most comprehensive measures of whether a project is profitable or unprofitable are the net present value (NPV) and internal rate of return (IRR). In addition to these, we present four other criteria that are frequently used: the payback period, discounted payback period, average accounting rate of return (AAR), and profitability index (PI). An analyst must fully understand the economic logic behind each of these investment decision criteria as well as its strengths and limitations in practice.

### 4.1 Net Present Value

For a project with one investment outlay, made initially, the **net present value (NPV)** is the present value of the future after-tax cash flows minus the investment outlay, or

$$\text{NPV} = \sum_{t=1}^n \frac{\text{CF}_t}{(1+r)^t} - \text{Outlay} \quad (1)$$

where

$\text{CF}_t$  = after-tax cash flow at time  $t$

$r$  = required rate of return for the investment

Outlay = investment cash flow at time zero

To illustrate the net present value criterion, we will take a look at a simple example. Assume that Gerhardt Corporation is considering an investment of €50 million in a capital project that will return after-tax cash flows of €16 million per year for the next four years plus another €20 million in Year 5. The required rate of return is 10 percent.

For the Gerhardt example, the NPV would be

$$NPV = \frac{16}{1.10^1} + \frac{16}{1.10^2} + \frac{16}{1.10^3} + \frac{16}{1.10^4} + \frac{20}{1.10^5} - 50$$

$$NPV = 14.545 + 13.223 + 12.021 + 10.928 + 12.418 - 50$$

$$NPV = 63.136 - 50 = €13.136 \text{ million}^1$$

The investment has a total value, or present value of future cash flows, of €63.136 million. Since this investment can be acquired at a cost of €50 million, the investing company is giving up €50 million of its wealth in exchange for an investment worth €63.136 million. The investor's wealth increases by a net of €13.136 million.

Because the NPV is the amount by which the investor's wealth increases as a result of the investment, the **decision rule** for the NPV is as follows:

Invest if	$NPV > 0$
Do not invest if	$NPV < 0$

Positive NPV investments are wealth-increasing, while negative NPV investments are wealth-decreasing.

Many investments have cash flow patterns in which outflows may occur not only at time zero, but also at future dates. It is useful to consider the NPV to be the present value of all cash flows:

$$NPV = CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \dots + \frac{CF_n}{(1+r)^n}, \text{ or}$$

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1+r)^t} \quad (2)$$

In Equation 2, the investment outlay,  $CF_0$ , is simply a negative cash flow. Future cash flows can also be negative.

## 4.2 Internal Rate of Return

The internal rate of return (IRR) is one of the most frequently used concepts in capital budgeting and in security analysis. The IRR definition is one that all analysts know by heart. For a project with one investment outlay, made initially, the IRR is the discount rate that makes the present value of the future after-tax cash flows equal that investment outlay. Written out in equation form, the IRR solves this equation:

$$\sum_{t=1}^n \frac{CF_t}{(1+IRR)^t} = \text{Outlay}$$

where IRR is the internal rate of return. The left-hand side of this equation is the present value of the project's future cash flows, which, discounted at the IRR, equals the investment outlay. This equation will also be seen rearranged as

$$\sum_{t=1}^n \frac{CF_t}{(1+IRR)^t} - \text{Outlay} = 0 \quad (3)$$

---

<sup>1</sup> Occasionally, you will notice some rounding errors in our examples. In this case, the present values of the cash flows, as rounded, add up to 63.135. Without rounding, they add up to 63.13627, or 63.136. We will usually report the more accurate result, the one that you would get from your calculator or computer without rounding intermediate results.

In this form, Equation 3 looks like the NPV equation, Equation 1, except that the discount rate is the IRR instead of  $r$  (the required rate of return). Discounted at the IRR, the NPV is equal to zero.

In the Gerhardt Corporation example, we want to find a discount rate that makes the total present value of all cash flows, the NPV, equal zero. In equation form, the IRR is the discount rate that solves this equation:

$$\begin{aligned} -50 + \frac{16}{(1 + \text{IRR})^1} + \frac{16}{(1 + \text{IRR})^2} + \frac{16}{(1 + \text{IRR})^3} \\ + \frac{16}{(1 + \text{IRR})^4} + \frac{20}{(1 + \text{IRR})^5} = 0 \end{aligned}$$

Algebraically, this equation would be very difficult to solve. We normally resort to trial and error, systematically choosing various discount rates until we find one, the IRR, that satisfies the equation. We previously discounted these cash flows at 10 percent and found the NPV to be €13.136 million. Since the NPV is positive, the IRR is probably greater than 10 percent. If we use 20 percent as the discount rate, the NPV is –€0.543 million, so 20 percent is a little high. One might try several other discount rates until the NPV is equal to zero; this approach is illustrated in Table 1:

**Table 1 Trial and Error Process for Finding IRR**

Discount Rate (%)	NPV
10	13.136
20	–0.543
19	0.598
19.5	0.022
19.51	0.011
19.52	0.000

The IRR is 19.52 percent. Financial calculators and spreadsheet software have routines that calculate the IRR for us, so we do not have to go through this trial and error procedure ourselves. The IRR, computed more precisely, is 19.5197 percent.

The decision rule for the IRR is to invest if the IRR exceeds the required rate of return for a project:

Invest if	IRR > $r$
Do not invest if	IRR < $r$

In the Gerhardt example, since the IRR of 19.52 percent exceeds the project's required rate of return of 10 percent, Gerhardt should invest.

Many investments have cash flow patterns in which the outlays occur at time zero and at future dates. Thus, it is common to define the IRR as the discount rate that makes the present values of all cash flows sum to zero:

$$\sum_{t=0}^n \frac{\text{CF}_t}{(1 + \text{IRR})^t} = 0 \quad (4)$$

Equation 4 is a more general version of Equation 3.

### 4.3 Payback Period

The payback period is the number of years required to recover the original investment in a project. The payback is based on cash flows. For example, if you invest \$10 million in a project, how long will it be until you recover the full original investment? Table 2 below illustrates the calculation of the payback period by following an investment's cash flows and cumulative cash flows.

**Table 2 Payback Period Example**

Year	0	1	2	3	4	5
Cash flow	-10,000	2,500	2,500	3,000	3,000	3,000
Cumulative cash flow	-10,000	-7,500	-5,000	-2,000	1,000	4,000

In the first year, the company recovers 2,500 of the original investment, with 7,500 still unrecovered. You can see that the company recoups its original investment between Year 3 and Year 4. After three years, 2,000 is still unrecovered. Since the Year 4 cash flow is 3,000, it would take two-thirds of the Year 4 cash flow to bring the cumulative cash flow to zero. So, the payback period is three years plus two-thirds of the Year 4 cash flow, or 3.67 years.

The drawbacks of the payback period are transparent. Since the cash flows are not discounted at the project's required rate of return, the payback period ignores the time value of money and the risk of the project. Additionally, the payback period ignores cash flows after the payback period is reached. In the table above, for example, the Year 5 cash flow is completely ignored in the payback computation!

Example 1 below is designed to illustrate some of the implications of these drawbacks of the payback period.

#### EXAMPLE 1

##### Drawbacks of the Payback Period

The cash flows, payback periods, and NPVs for Projects A through F are given in Table 3. For all of the projects, the required rate of return is 10 percent.

**Table 3 Examples of Drawbacks of the Payback Period**

Year	Cash Flows					
	Project A	Project B	Project C	Project D	Project E	Project F
0	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
1	1,000	100	400	500	400	500
2		200	300	500	400	500
3		300	200	500	400	10,000
4		400	100		400	
5		500	500		400	
Payback period	1.0	4.0	4.0	2.0	2.5	2.0
NPV	-90.91	65.26	140.60	243.43	516.31	7,380.92

Comment on why the payback period provides misleading information about the following:

- 1 Project A
- 2 Project B versus Project C
- 3 Project D versus Project E
- 4 Project D versus Project F

**Solution 1:**

Project A does indeed pay itself back in one year. However, this result is misleading because the investment is unprofitable, with a negative NPV.

**Solution 2:**

Although Projects B and C have the same payback period and the same cash flow after the payback period, the payback period does not detect the fact that Project C's cash flows within the payback period occur earlier and result in a higher NPV.

**Solution 3:**

Projects D and E illustrate a common situation. The project with the shorter payback period is the less profitable project. Project E has a longer payback and higher NPV.

**Solution 4:**

Projects D and F illustrate an important flaw of the payback period—that the payback period ignores cash flows after the payback period is reached. In this case, Project F has a much larger cash flow in Year 3, but the payback period does not recognize its value.

The payback period has many drawbacks—it is a measure of payback and not a measure of profitability. By itself, the payback period would be a dangerous criterion for evaluating capital projects. Its simplicity, however, is an advantage. The payback period is very easy to calculate and to explain. The payback period may also be used as an indicator of project liquidity. A project with a two-year payback may be more liquid than another project with a longer payback.

Because it is not economically sound, the payback period has no decision rule like that of the NPV or IRR. If the payback period is being used (perhaps as a measure of liquidity), analysts should also use an NPV or IRR to ensure that their decisions also reflect the profitability of the projects being considered.

#### 4.4 Discounted Payback Period

The discounted payback period is the number of years it takes for the cumulative discounted cash flows from a project to equal the original investment. The discounted payback period partially addresses the weaknesses of the payback period. Table 4 gives an example of calculating the payback period and discounted payback period. The example assumes a discount rate of 10 percent.

**Table 4 Payback Period and Discounted Payback Period**

<b>Year</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Cash flow (CF)	−5,000	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00
Cumulative CF	−5,000	−3,500.00	−2,000.00	−500.00	1,000.00	2,500.00
Discounted CF	−5,000	1,363.64	1,239.67	1,126.97	1,024.52	931.38
Cumulative discounted CF	−5,000	−3,636.36	−2,396.69	−1,269.72	−245.20	686.18

The payback period is three years plus  $500/1500 = \frac{1}{3}$  of the fourth year's cash flow, or 3.33 years. The discounted payback period is between four and five years. The discounted payback period is four years plus  $245.20/931.38 = 0.26$  of the fifth year's discounted cash flow, or 4.26 years.

The discounted payback period relies on discounted cash flows, much as the NPV criterion does. If a project has a negative NPV, it will usually not have a discounted payback period since it never recovers the initial investment.

The discounted payback does account for the time value of money and risk within the discounted payback period, but it ignores cash flows after the discounted payback period is reached. This drawback has two consequences. First, the discounted payback period is not a good measure of profitability (like the NPV or IRR) because it ignores these cash flows. Second, another idiosyncrasy of the discounted payback period comes from the possibility of negative cash flows after the discounted payback period is reached. It is possible for a project to have a negative NPV but to have a positive cumulative discounted cash flow in the middle of its life and, thus, a reasonable discounted payback period. The NPV and IRR, which consider all of a project's cash flows, do not suffer from this problem.

## 4.5 Average Accounting Rate of Return

The average accounting rate of return (AAR) can be defined as

$$\text{AAR} = \frac{\text{Average net income}}{\text{Average book value}}$$

To understand this measure of return, we will use a numerical example.

Assume a company invests \$200,000 in a project that is depreciated straight-line over a five-year life to a zero salvage value. Sales revenues and cash operating expenses for each year are as shown in Table 5. The table also shows the annual income taxes (at a 40 percent tax rate) and the net income.

**Table 5 Net Income for Calculating an Average Accounting Rate of Return**

	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Sales	\$100,000	\$150,000	\$240,000	\$130,000	\$80,000
Cash expenses	50,000	70,000	120,000	60,000	50,000
Depreciation	40,000	40,000	40,000	40,000	40,000
Earnings before taxes	10,000	40,000	80,000	30,000	−10,000

(continued)

**Table 5 (Continued)**

	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Taxes (at 40 percent)	4,000	16,000	32,000	12,000	-4,000 <sup>a</sup>
Net income	6,000	24,000	48,000	18,000	-6,000

<sup>a</sup> Negative taxes occur in Year 5 because the earnings before taxes of -\$10,000 can be deducted against earnings on other projects, thus reducing the tax bill by \$4,000.

For the five-year period, the average net income is \$18,000. The initial book value is \$200,000, declining by \$40,000 per year until the final book value is \$0. The average book value for this asset is  $(\$200,000 - \$0) / 2 = \$100,000$ . The average accounting rate of return is

$$\text{AAR} = \frac{\text{Average net income}}{\text{Average book value}} = \frac{18,000}{100,000} = 18\%$$

The advantages of the AAR are that it is easy to understand and easy to calculate. The AAR has some important disadvantages, however. Unlike the other capital budgeting criteria discussed here, the AAR is based on accounting numbers and not based on cash flows. This is an important conceptual and practical limitation. The AAR also does not account for the time value of money, and there is no conceptually sound cutoff for the AAR that distinguishes between profitable and unprofitable investments. The AAR is frequently calculated in different ways, so the analyst should verify the formula behind any AAR numbers that are supplied by someone else. Analysts should know the AAR and its potential limitations in practice, but they should rely on more economically sound methods like the NPV and IRR.

## 4.6 Profitability Index

The profitability index (PI) is the present value of a project's future cash flows divided by the initial investment. It can be expressed as

$$\text{PI} = \frac{\text{PV of future cash flows}}{\text{Initial investment}} = 1 + \frac{\text{NPV}}{\text{Initial investment}} \quad (5)$$

You can see that the PI is closely related to the NPV. The PI is the *ratio* of the PV of future cash flows to the initial investment, while an NPV is the *difference* between the PV of future cash flows and the initial investment. Whenever the NPV is positive, the PI will be greater than 1.0, and conversely, whenever the NPV is negative, the PI will be less than 1.0. The investment decision rule for the PI is as follows:

Invest if	PI > 1.0
Do not invest if	PI < 1.0

Because the PV of future cash flows equals the initial investment plus the NPV, the PI can also be expressed as 1.0 plus the ratio of the NPV to the initial investment, as shown in Equation 5 above. Example 2 illustrates the PI calculation.

**EXAMPLE 2****Example of a PI Calculation**

The Gerhardt Corporation investment (discussed earlier) had an outlay of €50 million, a present value of future cash flows of €63.136 million, and an NPV of €13.136 million. The profitability index is

$$\text{PI} = \frac{\text{PV of future cash flows}}{\text{Initial investment}} = \frac{63.136}{50.000} = 1.26$$

The PI can also be calculated as

$$\text{PI} = 1 + \frac{\text{NPV}}{\text{Initial investment}} = 1 + \frac{13.136}{50.000} = 1.26$$

Because the  $\text{PI} > 1.0$ , this is a profitable investment.

The PI indicates the value you are receiving in exchange for one unit of currency invested. Although the PI is used less frequently than the NPV and IRR, it is sometimes used as a guide in capital rationing, which we will discuss later. The PI is usually called the profitability index in corporations, but it is commonly referred to as a “benefit-cost ratio” in governmental and not-for-profit organizations.

**4.7 NPV Profile**

The NPV profile shows a project's NPV graphed as a function of various discount rates. Typically, the NPV is graphed vertically (on the  $y$ -axis) and the discount rates are graphed horizontally (on the  $x$ -axis). The NPV profile for the Gerhardt capital budgeting project is shown in Example 3.

**EXAMPLE 3****NPV Profile**

For the Gerhardt example, we have already calculated several NPVs for different discount rates. At 10 percent the NPV is €13.136 million; at 20 percent the NPV is –€0.543 million; and at 19.52 percent (the IRR), the NPV is zero. What is the NPV if the discount rate is 0 percent? The NPV discounted at 0 percent is €34 million, which is simply the sum of all of the undiscounted cash flows. Table 6 and Figure 1 show the NPV profile for the Gerhardt example for discount rates between 0 percent and 30 percent.

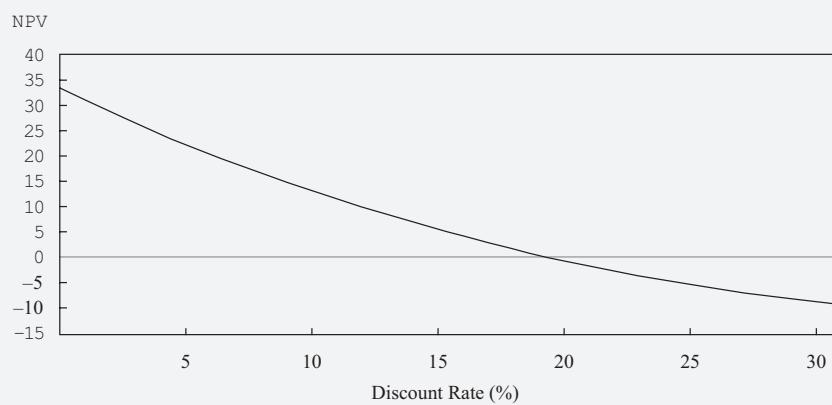
**Table 6 Gerhardt NPV Profile**

<b>Discount Rate (%)</b>	<b>NPV (in € Millions)</b>
0	34.000
5.00	22.406
10.00	13.136
15.00	5.623
19.52	0.000
20.00	-0.543

*(continued)*

**Table 6 (Continued)**

<b>Discount Rate (%)</b>	<b>NPV (in € Millions)</b>
25.00	-5.661
30.00	-9.954

**Figure 1 Gerhardt NPV Profile**

Three interesting points on this NPV profile are where the profile goes through the vertical axis (the NPV when the discount rate is zero), where the profile goes through the horizontal axis (where the discount rate is the IRR), and the NPV for the required rate of return (NPV is €13.136 million when the discount rate is the 10 percent required rate of return).

The NPV profile in Figure 1 is very well-behaved. The NPV declines at a decreasing rate as the discount rate increases. The profile is convex from the origin (convex from below). You will shortly see some examples in which the NPV profile is more complicated.

## 4.8 Ranking Conflicts between NPV and IRR

For a single conventional project, the NPV and IRR will agree on whether to invest or to not invest. For independent, conventional projects, no conflict exists between the decision rules for the NPV and IRR. However, in the case of two mutually exclusive projects, the two criteria will sometimes disagree. For example, Project A might have a larger NPV than Project B, but Project B has a higher IRR than Project A. In this case, should you invest in Project A or in Project B?

Differing cash flow patterns can cause two projects to rank differently with the NPV and IRR. For example, suppose Project A has shorter-term payoffs than Project B. This situation is presented in Example 4.

**EXAMPLE 4****Ranking Conflict Due to Differing Cash Flow Patterns**

Projects A and B have similar outlays but different patterns of future cash flows. Project A realizes most of its cash payoffs earlier than Project B. The cash flows as well as the NPV and IRR for the two projects are shown in Table 7. For both projects, the required rate of return is 10 percent.

**Table 7 Cash Flows, NPV, and IRR for Two Projects with Different Cash Flow Patterns**

Year	Cash Flows					NPV	IRR (%)
	0	1	2	3	4		
Project A	-200	80	80	80	80	53.59	21.86
Project B	-200	0	0	0	400	73.21	18.92

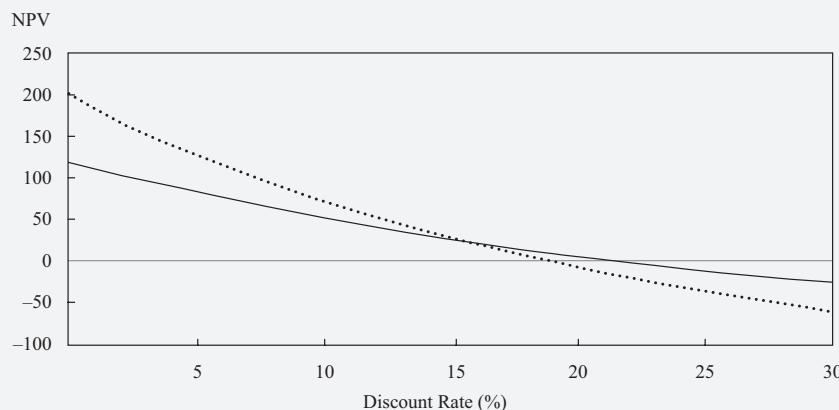
If the two projects were not mutually exclusive, you would invest in both because they are both profitable. However, you can choose either A (which has the higher IRR) or B (which has the higher NPV).

Table 8 and Figure 2 show the NPVs for Project A and Project B for various discount rates between 0 percent and 30 percent.

**Table 8 NPV Profiles for Two Projects with Different Cash Flow Patterns**

Discount Rate (%)	NPV for Project A	NPV for Project B
0	120.00	200.00
5.00	83.68	129.08
10.00	53.59	73.21
15.00	28.40	28.70
15.09	27.98	27.98
18.92	11.41	0.00
20.00	7.10	-7.10
21.86	0.00	-18.62
25.00	-11.07	-36.16
30.00	-26.70	-59.95

**Figure 2 NPV Profiles for Two Projects with Different Cash Flow Patterns**



Note that Project B has the higher NPV for discount rates between 0 percent and 15.09 percent. Project A has the higher NPV for discount rates exceeding 15.09 percent. The crossover point of 15.09 percent in Figure 2 corresponds to the discount rate at which both projects have the same NPV (of 27.98). Project B has the higher NPV below the crossover point, and Project A has the higher NPV above it.

Whenever the NPV and IRR rank two mutually exclusive projects differently, as they do in the example above, you should choose the project based on the NPV. Project B, with the higher NPV, is the better project because of the reinvestment assumption. Mathematically, whenever you discount a cash flow at a particular discount rate, you are implicitly assuming that you can reinvest a cash flow at that same discount rate.<sup>2</sup> In the NPV calculation, you use a discount rate of 10 percent for both projects. In the IRR calculation, you use a discount rate equal to the IRR of 21.86 percent for Project A and 18.92 percent for Project B.

Can you reinvest the cash inflows from the projects at 10 percent, or 21.86 percent, or 18.92 percent? When you assume the required rate of return is 10 percent, you are assuming an opportunity cost of 10 percent—you are assuming that you can either find other projects that pay a 10 percent return or pay back your sources of capital that cost you 10 percent. The fact that you earned 21.86 percent in Project A or 18.92 percent in Project B does not mean that you can reinvest future cash flows at those rates. (In fact, if you can reinvest future cash flows at 21.86 percent or 18.92 percent, these should have been used as your required rate of return instead of 10 percent.) Because the NPV criterion uses the most realistic discount rate—the opportunity cost of funds—the NPV criterion should be used for evaluating mutually exclusive projects.

<sup>2</sup> For example, assume that you are receiving \$100 in one year discounted at 10 percent. The present value is  $\$100/1.10 = \$90.91$ . Instead of receiving the \$100 in one year, invest it for one additional year at 10 percent, and it grows to \$110. What is the present value of \$110 received in two years discounted at 10 percent? It is the same \$90.91. Because both future cash flows are worth the same, you are implicitly assuming that reinvesting the earlier cash flow at the discount rate of 10 percent has no effect on its value.

Another circumstance that frequently causes mutually exclusive projects to be ranked differently by NPV and IRR criteria is project scale—the sizes of the projects. Would you rather have a small project with a higher rate of return or a large project with a lower rate of return? Sometimes, the larger, low rate of return project has the better NPV. This case is developed in Example 5.

**EXAMPLE 5****Ranking Conflicts Due to Differing Project Scale**

Project A has a much smaller outlay than Project B, although they have similar future cash flow patterns. The cash flows as well as the NPVs and IRRs for the two projects are shown in Table 9. For both projects, the required rate of return is 10 percent.

**Table 9 Cash Flows, NPV, and IRR for Two Projects of Differing Scale**

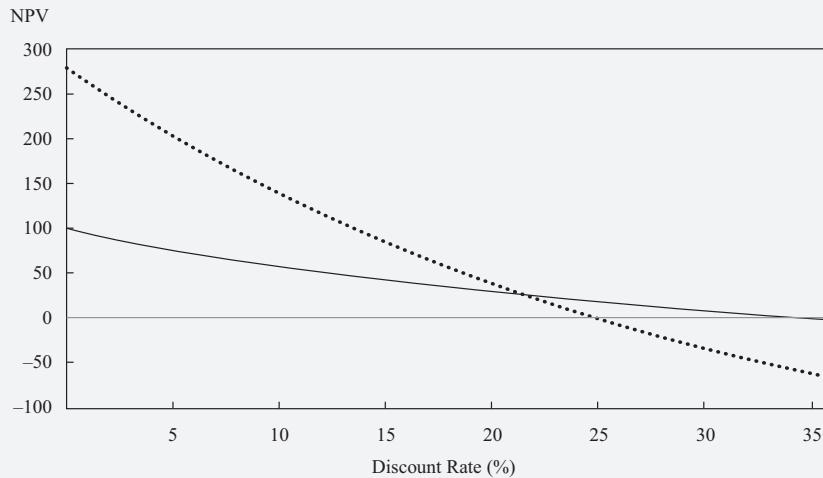
Year	Cash Flows					NPV	IRR (%)
	0	1	2	3	4		
Project A	-100	50	50	50	50	58.49	34.90
Project B	-400	170	170	170	170	138.88	25.21

If they were not mutually exclusive, you would invest in both projects because they are both profitable. However, you can choose either Project A (which has the higher IRR) or Project B (which has the higher NPV).

Table 10 and Figure 3 show the NPVs for Project A and Project B for various discount rates between 0 percent and 30 percent.

**Table 10 NPV Profiles for Two Projects of Differing Scale**

Discount Rate (%)	NPV for Project A	NPV for Project B
0	100.00	280.00
5.00	77.30	202.81
10.00	58.49	138.88
15.00	42.75	85.35
20.00	29.44	40.08
21.86	25.00	25.00
25.00	18.08	1.47
25.21	17.65	0.00
30.00	8.31	-31.74
34.90	0.00	-60.00
35.00	-0.15	-60.52

**Figure 3 NPV Profiles for Two Projects of Differing Scale**

Note that Project B has the higher NPV for discount rates between 0 percent and 21.86 percent. Project A has the higher NPV for discount rates exceeding 21.86 percent. The crossover point of 21.86 percent in Figure 3 corresponds to the discount rate at which both projects have the same NPV (of 25.00). Below the crossover point, Project B has the higher NPV, and above it, Project A has the higher NPV. When cash flows are discounted at the 10 percent required rate of return, the choice is clear—Project B, the larger project, which has the superior NPV.

The good news is that the NPV and IRR criteria will usually indicate the same investment decision for a given project. They will usually both recommend acceptance or rejection of the project. When the choice is between two mutually exclusive projects and the NPV and IRR rank the two projects differently, the NPV criterion is strongly preferred. There are good reasons for this preference. The NPV shows the amount of gain, or wealth increase, as a currency amount. The reinvestment assumption of the NPV is the more economically realistic. The IRR does give you a rate of return, but the IRR could be for a small investment or for only a short period of time. As a practical matter, once a corporation has the data to calculate the NPV, it is fairly trivial to go ahead and calculate the IRR and other capital budgeting criteria. However, the most appropriate and theoretically sound criterion is the NPV.

## 4.9 The Multiple IRR Problem and the No IRR Problem

A problem that can arise with the IRR criterion is the “multiple IRR problem.” We can illustrate this problem with the following nonconventional cash flow pattern:<sup>3</sup>

Time	0	1	2
Cash Flow	-1,000	5,000	-6,000

The IRR for these cash flows satisfies this equation:

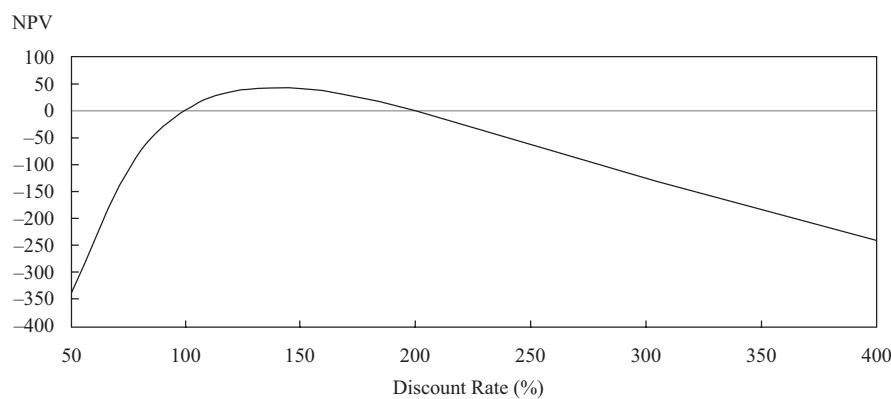
$$-1,000 + \frac{5,000}{(1 + \text{IRR})^1} + \frac{-6,000}{(1 + \text{IRR})^2} = 0$$

<sup>3</sup> This example is adapted from Hirshleifer (1958).

It turns out that there are two values of IRR that satisfy the equation:  $IRR = 1 = 100\%$  and  $IRR = 2 = 200\%$ . To further understand this problem, consider the NPV profile for this investment, which is shown in Table 11 and Figure 4.

**Table 11** NPV Profile for a Multiple IRR Example

Discount Rate (%)	NPV
0	-2,000.00
25	-840.00
50	-333.33
75	-102.04
100	0.00
125	37.04
140	41.67
150	40.00
175	24.79
200	0.00
225	-29.59
250	-61.22
300	-125.00
350	-185.19
400	-240.00
500	-333.33
1,000	-595.04
2,000	-775.51
3,000	-844.95
4,000	-881.62
10,000	-951.08
1,000,000	-999.50

**Figure 4** NPV Profile for a Multiple IRR Example

As you can see in the NPV profile, the NPV is equal to zero at IRR = 100% and IRR = 200%. The NPV is negative for discount rates below 100 percent, positive between 100 percent and 200 percent, and then negative above 200 percent. The NPV reaches its highest value when the discount rate is 140 percent.

It is also possible to have an investment project with no IRR. The “no-IRR problem” occurs with this cash flow pattern:<sup>4</sup>

Time	0	1	2
Cash Flow	100	-300	250

The IRR for these cash flows satisfies this equation:

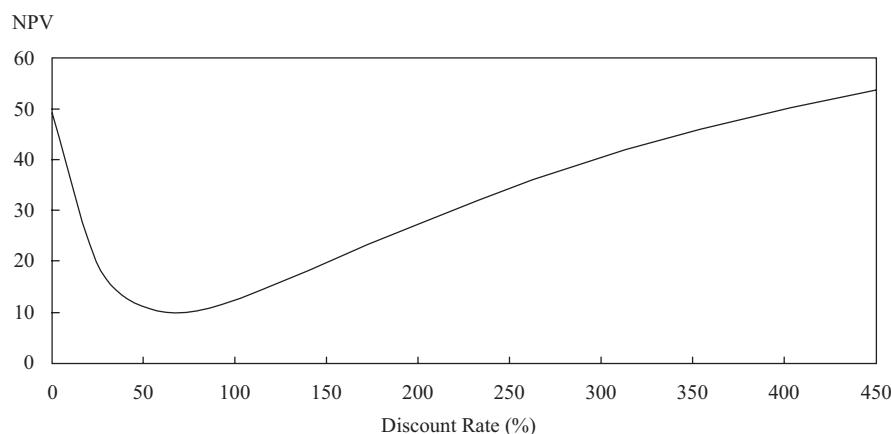
$$100 + \frac{-300}{(1 + \text{IRR})^1} + \frac{250}{(1 + \text{IRR})^2} = 0$$

For these cash flows, no discount rate exists that results in a zero NPV. Does that mean this project is a bad investment? In this case, the project is actually a good investment. As Table 12 and Figure 5 show, the NPV is positive for all discount rates. The lowest NPV, of 10, occurs for a discount rate of 66.67 percent, and the NPV is always greater than zero. Consequently, no IRR exists.

**Table 12 NPV Profile for a Project with No IRR**

Discount Rate (%)	NPV
0	50.00
25	20.00
50	11.11
66.67	10.00
75	10.20
100	12.50
125	16.05
150	20.00
175	23.97
200	27.78
225	31.36
250	34.69
275	37.78
300	40.63
325	43.25
350	45.68
375	47.92
400	50.00

<sup>4</sup> This example is also adapted from Hirschleifer.

**Figure 5 NPV Profile for a Project with No IRR**

For conventional projects that have outlays followed by inflows—negative cash flows followed by positive cash flows—the multiple IRR problem cannot occur. However, for nonconventional projects, as in the example above, the multiple IRR problem can occur. The IRR equation is essentially an  $n$ th degree polynomial. An  $n$ th degree polynomial can have up to  $n$  solutions, although it will have no more real solutions than the number of cash flow sign changes. For example, a project with two sign changes could have zero, one, or two IRRs. Having two sign changes does not mean that you *will* have multiple IRRs; it just means that you *might*. Fortunately, most capital budgeting projects have only one IRR. Analysts should always be aware of the unusual cash flow patterns that can generate the multiple IRR problem.

## 4.10 Popularity and Usage of the Capital Budgeting Methods

Analysts need to know the basic logic of the various capital budgeting criteria as well as the practicalities involved in using them in real corporations. Before delving into the many issues involved in applying these models, we would like to present some feedback on their popularity.

The usefulness of any analytical tool always depends on the specific application. Corporations generally find these capital budgeting criteria useful. Two surveys by Graham and Harvey (2001) and Brounen, De Jong, and Koedijk (2004) report on the frequency of their use by US and European corporations. Table 13 gives the mean responses of executives in five countries to the question “How frequently does your company use the following techniques when deciding which projects or acquisitions to pursue?”

**Table 13 Mean Responses about Frequency of Use of Capital Budgeting Techniques**

	US	UK	Netherlands	Germany	France
Internal rate of return <sup>a</sup>	3.09	2.31	2.36	2.15	2.27
Net present value <sup>a</sup>	3.08	2.32	2.76	2.26	1.86
Payback period <sup>a</sup>	2.53	2.77	2.53	2.29	2.46
Hurdle rate	2.13	1.35	1.98	1.61	0.73
Sensitivity analysis	2.31	2.21	1.84	1.65	0.79
Earnings multiple approach	1.89	1.81	1.61	1.25	1.70

(continued)

**Table 13 (Continued)**

	<b>US</b>	<b>UK</b>	<b>Netherlands</b>	<b>Germany</b>	<b>France</b>
Discounted payback period <sup>a</sup>	1.56	1.49	1.25	1.59	0.87
Real options approach	1.47	1.65	1.49	2.24	2.20
Accounting rate of return <sup>a</sup>	1.34	1.79	1.40	1.63	1.11
Value at risk	0.95	0.85	0.51	1.45	1.68
Adjusted present value	0.85	0.78	0.78	0.71	1.11
Profitability index <sup>a</sup>	0.85	1.00	0.78	1.04	1.64

<sup>a</sup> These techniques were described in this section of the reading. You will encounter the others elsewhere.

*Note:* Respondents used a scale ranging from 0 (never) to 4 (always).

Although financial textbooks preach the superiority of the NPV and IRR techniques, it is clear that several other methods are heavily used.<sup>5</sup> In the four European countries, the payback period is used as often as, or even slightly more often than, the NPV and IRR. In these two studies, larger companies tended to prefer the NPV and IRR over the payback period. The fact that the US companies were larger, on average, partially explains the greater US preference for the NPV and IRR. Other factors influence the choice of capital budgeting techniques. Private corporations used the payback period more frequently than did public corporations. Companies managed by an MBA had a stronger preference for the discounted cash flow techniques. Of course, any survey research also has some limitations. In this case, the persons in these large corporations responding to the surveys may not have been aware of all of the applications of these techniques.

These capital budgeting techniques are essential tools for corporate managers. Capital budgeting is also relevant to external analysts. Because a corporation's investing decisions ultimately determine the value of its financial obligations, the corporation's investing processes are vital. The NPV criterion is the criterion most directly related to stock prices. If a corporation invests in positive NPV projects, these should add to the wealth of its shareholders. Example 6 illustrates this scenario.

### EXAMPLE 6

#### NPVs and Stock Prices

Freitag Corporation is investing €600 million in distribution facilities. The present value of the future after-tax cash flows is estimated to be €850 million. Freitag has 200 million outstanding shares with a current market price of €32.00 per share. This investment is new information, and it is independent of other expectations about the company. What should be the effect of the project on the value of the company and the stock price?

#### Solution:

The NPV of the project is €850 million – €600 million = €250 million. The total market value of the company prior to the investment is  $€32.00 \times 200 \text{ million shares} = €6,400 \text{ million}$ . The value of the company should increase by €250 million

<sup>5</sup> Analysts often refer to the NPV and IRR as "discounted cash flow techniques" because they accurately account for the timing of all cash flows when they are discounted.

to €6,650 million. The price per share should increase by the NPV per share, or €250 million/200 million shares = €1.25 per share. The share price should increase from €32.00 to €33.25.

The effect of a capital budgeting project's positive or negative NPV on share price is more complicated than Example 6 above, in which the value of the stock increased by the project's NPV. The value of a company is the value of its existing investments plus the net present values of all of its future investments. If an analyst learns of an investment, the impact of that investment on the stock price will depend on whether the investment's profitability is more or less than expected. For example, an analyst could learn of a positive NPV project, but if the project's profitability is less than expectations, this stock might drop in price on the news. Alternatively, news of a particular capital project might be considered as a signal about other capital projects underway or in the future. A project that by itself might add, say, €0.25 to the value of the stock might signal the existence of other profitable projects. News of this project might increase the stock price by far more than €0.25.

The integrity of a corporation's capital budgeting processes is important to analysts. Management's capital budgeting processes can demonstrate two things about the quality of management: the degree to which management embraces the goal of shareholder wealth maximization, and its effectiveness in pursuing that goal. Both of these factors are important to shareholders.

**END OPTIONAL  
SEGMENT**

## CASH FLOW PROJECTIONS

**5**

In Section 4, we presented the basic capital budgeting models that managers use to accept or reject capital budgeting proposals. In that section, we assumed the cash flows were given, and we used them as inputs to the analysis. In Section 5, we detail how these cash flows are found for an "expansion" project. An expansion project is an independent investment that does not affect the cash flows for the rest of the company. In Section 6, we will deal with a "replacement" project, in which the cash flow analysis is more complicated. A replacement project must deal with the differences between the cash flows that occur with the new investment and the cash flows that would have occurred for the investment being replaced.

### 5.1 Table Format with Cash Flows Collected by Year

The cash flows for a conventional expansion project can be grouped into 1) the investment outlays, 2) after-tax operating cash flows over the project's life, and 3) terminal year after-tax non-operating cash flows. Table 14 gives an example of the cash flows for a capital project where all of the cash flows are collected by year.

**Table 14 Capital Budgeting Cash Flows Example (Cash Flows Collected by Year)**

Year	0	1	2	3	4	5
<i>Investment outlays:</i>						
Fixed capital		-200,000				
Net working capital		-30,000				
Total		-230,000				

(continued)

**Table 14 (Continued)**

<b>Year</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<i>Annual after-tax operating cash flows:</i>						
Sales	220,000	220,000	220,000	220,000	220,000	220,000
Cash operating expenses	90,000	90,000	90,000	90,000	90,000	90,000
Depreciation	35,000	35,000	35,000	35,000	35,000	35,000
Operating income before taxes	95,000	95,000	95,000	95,000	95,000	95,000
Taxes on operating income	38,000	38,000	38,000	38,000	38,000	38,000
Operating income after taxes	57,000	57,000	57,000	57,000	57,000	57,000
Add back: Depreciation	35,000	35,000	35,000	35,000	35,000	35,000
After-tax operating cash flow	92,000	92,000	92,000	92,000	92,000	92,000
<i>Terminal year after-tax non-operating cash flows:</i>						
After-tax salvage value						40,000
Return of net working capital						30,000
Total						70,000
Total after-tax cash flow	-230,000	92,000	92,000	92,000	92,000	162,000
Net present value at 10 percent required rate of return	162,217					
Internal rate of return	32.70%					

The investment outlays include a \$200,000 outlay for fixed capital items. This outlay includes \$25,000 for nondepreciable land, plus \$175,000 for equipment that will be depreciated straight-line to zero over five years. The investment in net working capital is the net investment in short-term assets required for the investment. This is the investment in receivables and inventory needed, less the short-term payables generated by the project. In this case, the project required \$50,000 of current assets but generated \$20,000 in current liabilities, resulting in a total investment in net working capital of \$30,000. The total investment outlay at time zero is \$230,000.

Each year, sales will be \$220,000 and cash operating expenses will be \$90,000. Annual depreciation for the \$175,000 depreciable equipment is \$35,000 (one-fifth of the cost). The result is an operating income before taxes of \$95,000. Income taxes at a 40 percent rate are  $0.40 \times \$95,000 = \$38,000$ . This leaves operating income after taxes of \$57,000. Adding back the depreciation charge of \$35,000 gives the annual after-tax operating cash flow of \$92,000.<sup>6</sup>

At the end of Year 5, the company will sell off the fixed capital assets. In this case, the fixed capital assets (including the land) are sold for \$50,000, which represents a gain of \$25,000 over the remaining book value of \$25,000. The gain of \$25,000 is taxed at 40 percent, resulting in a tax of \$10,000. This leaves \$40,000 for the fixed capital assets after taxes. Additionally, the net working capital investment of \$30,000 is recovered, as the short-term assets (such as inventory and receivables) and short-term liabilities (such as payables) are no longer needed for the project. Total terminal year non-operating cash flows are then \$70,000.

<sup>6</sup> Examining the operating cash flows in Table 14, we have a \$220,000 inflow from sales, a \$90,000 outflow for cash operating expenses, and a \$38,000 outflow for taxes. This is an after-tax cash flow of \$92,000.

The investment project has a required rate of return of 10 percent. Discounting the future cash flows at 10 percent and subtracting the investment outlay gives an NPV of \$162,217. The internal rate of return is 32.70 percent. Because the investment has a positive NPV, this project should be accepted. The IRR investment decision criterion would also recommend accepting the project because the IRR is greater than the required rate of return.

## 5.2 Table Format with Cash Flows Collected by Type

In the layout in Table 14, we essentially collected the cash flows in the columns, by *year*, and then found the NPV by summing the present values of the annual cash flows (at the bottom of each column). There is another way of organizing the same information. We could also find the NPV by finding the present values of the cash flows in Table 14 by rows, which are the *types* of cash flows. This approach is shown in Table 15:

**Table 15 Capital Budgeting Cash Flows Example (Cash Flows Collected by Type)**

Time	Type of Cash Flow	Before-Tax Cash Flow	After-Tax Cash Flow	PV at 10%
0	Fixed capital	-200,000	-200,000	-200,000
0	Net working capital	-30,000	-30,000	-30,000
1–5	Sales minus cash expenses	220,000 - 90,000 = 130,000	130,000(1 - 0.40) = 78,000	295,681
1–5	Depreciation tax savings	None	0.40(35,000) = 14,000	53,071
5	After-tax salvage value	50,000	50,000 - 0.40(50,000 - 25,000) = 40,000	24,837
5	Return of net working capital	30,000	30,000	18,628
			NPV=	162,217

As Table 15 shows, the outlays in fixed capital and in net working capital at time zero total \$230,000. For Years 1 through 5, the company realizes an after-tax cash flow for sales minus cash expenses of \$78,000, which has a present value of \$295,681. The depreciation charge results in a tax savings of \$14,000 per year, which has a present value of \$53,071. The present values of the after-tax salvage and of the return of net working capital are also shown in the table. The present value of all cash flows is an NPV of \$162,217. Obviously, collecting the after-tax cash flows by year, as in Table 14, or by type, as in Table 15, results in the same NPV.

## 5.3 Equation Format for Organizing Cash Flows

The capital budgeting cash flows in the example project above were laid out in one of two alternative tabular formats. Analysts may wish to take even another approach. Instead of producing a table, you can also look at the cash flows using equations such as the following:

- 1 Initial outlay: For a new investment:

$$\text{Outlay} = \text{FCInv} + \text{NWCInv}$$

where

FCInv = investment in new fixed capital

NWCInv = investment in net working capital

This equation can be generalized for a replacement project (covered in Section 6.2), in which existing fixed capital is sold and provides some of the funding for the new fixed capital purchased. The outlay is then

$$\text{Outlay} = \text{FCInv} + \text{NWCInv} - \text{Sal}_0 + T(\text{Sal}_0 - B_0) \quad (6)$$

where

$\text{Sal}_0$  = cash proceeds (salvage value) from sale of old fixed capital

T = tax rate

$B_0$  = book value of old fixed capital

**2** Annual after-tax operating cash flow:

$$\text{CF} = (S - C - D)(1 - T) + D, \text{ or} \quad (7)$$

$$\text{CF} = (S - C)(1 - T) + TD \quad (8)$$

where

S = sales

C = cash operating expenses

D = depreciation charge

**3** Terminal year after-tax non-operating cash flow:

$$\text{TNOCF} = \text{Sal}_T + \text{NWCInv} - T(\text{Sal}_T - B_T) \quad (9)$$

where

$\text{Sal}_T$  = cash proceeds (salvage value) from sale of fixed capital on **termination date**

$B_T$  = book value of fixed capital on termination date

The outlay in the example is found with Equation 6:

$$\text{Outlay} = 200,000 + 30,000 - 0 + 0 = \$230,000$$

For a replacement project, the old fixed capital would be sold for cash ( $\text{Sal}_0$ ) and then there would be taxes paid on the gain (if  $\text{Sal}_0 - B_0$  were positive) or a tax saving (if  $\text{Sal}_0 - B_0$  were negative). In this example,  $\text{Sal}_0$  and  $T(\text{Sal}_0 - B_0)$  are zero because no existing fixed capital is sold at time zero.

Using Equation 7, we find that the annual after-tax operating cash flow is

$$\begin{aligned} \text{CF} &= (S - C - D)(1 - T) + D \\ &= (220,000 - 90,000 - 35,000)(1 - 0.40) + 35,000 \\ &= 95,000 \times (0.60) + 35,000 \\ &= 57,000 + 35,000 = \$92,000 \end{aligned}$$

Equation 7 is the project's net income plus depreciation. An identical cash flow results if we use Equation 8:

$$\begin{aligned} \text{CF} &= (S - C)(1 - T) + TD \\ &= (220,000 - 90,000)(1 - 0.40) + 0.40(35,000) \\ &= 130,000(0.60) + 0.40(35,000) = 78,000 + 14,000 = \$92,000 \end{aligned}$$

Equation 8 is the after-tax sales and cash expenses plus the depreciation tax savings. The analyst can use either equation.

Equation 9 provides the terminal year non-operating cash flow:

$$\begin{aligned} \text{TNOCF} &= \text{Sal}_T + \text{NWCInv} - T(\text{Sal}_T - \text{B}_T) \\ &= 50,000 + 30,000 - 0.40(50,000 - 25,000) \\ &= 50,000 + 30,000 - 10,000 = \$70,000 \end{aligned}$$

The old fixed capital (including land) is sold for \$50,000, but \$10,000 of taxes must be paid on the gain. Including the \$30,000 return of net working capital gives a terminal year non-operating cash flow of \$70,000.

The NPV of the project is the present value of the cash flows—an outlay of \$230,000 at time zero, an annuity of \$92,000 for five years, plus a single payment of \$70,000 in five years:

$$\begin{aligned} \text{NPV} &= -230,000 + \sum_{t=1}^5 \frac{92,000}{(1.10)^t} + \frac{70,000}{(1.10)^5} \\ &= -230,000 + 348,752 + 43,465 = \$162,217 \end{aligned}$$

We obtain an identical NPV of \$162,217 whether we use a tabular format collecting cash flows by year, a tabular format collecting cash flows by type, or an equation format using Equations 6 through 9. The analyst usually has some flexibility in choosing how to solve a problem. Furthermore, the analysis that an analyst receives from someone else could be in varying formats. The analyst must interpret this information correctly regardless of format. An analyst may need to present information in alternative formats, depending on what the client or user of the information wishes to see. All that is important is that the cash flows are complete (with no cash flows omitted and none double-counted), that their timing is recognized, and that the discounting is done correctly.

## MORE ON CASH FLOW PROJECTIONS

# 6

Cash flow analysis can become fairly complicated. Section 6 extends the analysis of the previous section to include more details on depreciation methods, replacement projects (as opposed to simple expansion projects), the use of spreadsheets, and the effects of inflation.

### 6.1 Straight-Line and Accelerated Depreciation Methods

Before going on to more complicated investment decisions, we should mention the variety of depreciation methods that are in use. The example in Section 5.1 assumed straight-line depreciation down to a zero salvage value. Most accounting texts give a good description of the straight-line method, the sum-of-years digits method, the double-declining balance method (and the 150 percent declining balance method), and the units-of-production and service hours method.<sup>7</sup>

Many countries specify the depreciation methods that are acceptable for tax purposes in their jurisdictions. For example, in the United States, corporations use the MACRS (modified accelerated cost recovery system) for tax purposes. Under MACRS, real property (real estate) is usually depreciated straight-line over a 27.5- or

<sup>7</sup> White, Sondhi, and Fried (2003) is a good example. Consult their Chapter 8, "Analysis of Long-Lived Assets: Part II—Analysis of Depreciation and Impairment," for review and examples.

39-year life, and other capital assets are usually grouped into MACRS asset classes and subject to a special depreciation schedule in each class. These MACRS classes and the depreciation rates for each class are shown in Table 16.

**Table 16 Depreciation Rates under US MACRS**

<b>Year</b>	<b>Recovery Period Class</b>					
	<b>3-Year</b>	<b>5-Year</b>	<b>7-Year</b>	<b>10-Year</b>	<b>15-Year</b>	<b>20-Year</b>
1	33.33%	20.00%	14.29%	10.00%	5.00%	3.75%
2	44.45	32.00	24.49	18.00	9.50	7.22
3	14.81	19.20	17.49	14.40	8.55	6.68
4	7.41	11.52	12.49	11.52	7.70	6.18
5		11.52	8.93	9.22	6.93	5.71
6		5.76	8.93	7.37	6.23	5.28
7			8.93	6.55	5.90	4.89
8			4.45	6.55	5.90	4.52
9				6.55	5.90	4.46
10				6.55	5.90	4.46
11				3.29	5.90	4.46
12					5.90	4.46
13					5.90	4.46
14					5.90	4.46
15					5.90	4.46
16					2.99	4.46
17						4.46
18						4.46
19						4.46
20						4.46
21						2.25

For the first four MACRS classes (3-year, 5-year, 7-year, and 10-year), the depreciation is double-declining-balance with a switch to straight-line when optimal and with a half-year convention. For the last two classes (15-year and 20-year), the depreciation is 150 percent-declining-balance with a switch to straight-line when optimal and with a half-year convention. Take 5-year property in Table 16 as an example. With double-declining-balance, the depreciation each year is  $2/5 = 40\%$  of the beginning-of-year book value. However, with a half-year convention, the asset is assumed to be in service for only six months during the first year, and only one-half of the depreciation is allowed the first year. After the first year, the depreciation rate is 40 percent of the beginning balance until Year 4, when straight-line depreciation would be at least as large, so we switch to straight-line. In Year 6, we have one-half of a year of the straight-line depreciation remaining because we assumed the asset was placed in service half-way through the first year.

Accelerated depreciation generally improves the NPV of a capital project compared to straight-line depreciation. For an example of this effect, we will assume the same capital project as in Table 14, except that the depreciation is MACRS 3-year property. When using straight-line, the depreciation was 20 percent per year (\$35,000).

The depreciation percentages for MACRS 3-year property are given in Table 16. The first-year depreciation is  $0.3333 \times 175,000 = \$58,327.50$ , second year depreciation is  $0.4445 \times 175,000 = \$77,787.50$ , third year depreciation is  $0.1481 \times 175,000 = \$25,917.50$ , fourth year depreciation is  $0.0741 \times 175,000 = \$12,967.50$ , and fifth year depreciation is zero. The impact on the NPV and IRR of the project is shown in Table 17.

**Table 17 Capital Budgeting Example with MACRS**

Year	0	1	2	3	4	5
<i>Investment outlays:</i>						
Fixed capital		-200,000				
Net working capital		-30,000				
Total		-230,000				
<i>Annual after-tax operating cash flows:</i>						
Sales	220,000	220,000	220,000	220,000	220,000	220,000
Cash operating expenses	90,000	90,000	90,000	90,000	90,000	90,000
Depreciation	58,328	77,788	25,918	12,968	0	
Operating income before taxes	71,673	52,213	104,083	117,033	130,000	
Taxes on operating income (40%)	28,669	20,885	41,633	46,813	52,000	
Operating income after taxes	43,004	31,328	62,450	70,220	78,000	
Add back: Depreciation	58,328	77,788	25,918	12,968	0	
After-tax operating cash flow	101,331	109,115	88,367	83,187	78,000	
<i>Terminal year after-tax non-operating cash flows:</i>						
After-tax salvage value						40,000
Return of net working capital						30,000
Total						70,000
Total after-tax cash flows	-230,000	101,331	109,115	88,367	83,187	148,000
Net present value at 10% required rate of return	\$167,403					
Internal rate of return		34.74%				

As the table shows, the depreciation charges still sum to \$175,000 (except for \$2 of rounding), but they are larger in Years 1 and 2 and smaller in Years 3, 4, and 5. Although this method reduces operating income after taxes in Years 1 and 2 (and increases it in Years 3, 4, and 5), it reduces tax outflows in Years 1 and 2 and increases them later. Consequently, the after-tax operating cash flows (which were \$92,000 per year) increase in early years and decrease in later years. This increases the NPV from \$162,217 to \$167,403, a difference of \$5,186. The IRR also increases from 32.70 percent to 34.74 percent.<sup>8</sup>

<sup>8</sup> This example assumes that the investment occurs on the first day of the tax year. If the outlay occurs later in the tax year, the depreciation tax savings for the tax years are unchanged, which means that the cash savings occur sooner, increasing their present values. The result is a higher NPV and IRR.

The impact of accelerated depreciation can be seen without going through the complete analysis in Table 17. We previously showed in Table 15 that the present value of the depreciation tax savings (which was an annuity of  $0.40 \times \$35,000 = \$14,000$  a year for five years) was \$53,071. The present value of the tax savings from accelerated depreciation is shown in Table 18.

**Table 18 Present Value of Tax Savings from Accelerated Depreciation**

Year	Depreciation (\$)	Tax Savings	PV at 10% (\$)
1	58,327.50	$0.40 \times \$58,327.5 = \$23,331$	21,210
2	77,787.50	$0.40 \times \$77,787.5 = \$31,115$	25,715
3	25,917.50	$0.40 \times \$25,917.5 = \$10,367$	7,789
4	12,967.50	$0.40 \times \$12,967.5 = \$5,187$	3,543
5	0	$0.40 \times \$0 = \$0$	0
Total present value			58,257

By using the accelerated depreciation schedule, we increase the present value of the tax savings from \$53,071 (from Table 15) to \$58,257, an increase of \$5,186. The tax deferral associated with the accelerated depreciation (compared to straight-line) adds \$5,186 to the NPV of the project.

There are a myriad of tax and depreciation schedules that apply to investment projects around the world. These tax and depreciation schedules are also subject to change from year to year. To accurately assess the profitability of a particular capital project, it is vital to identify and apply the schedules that are relevant to the capital budgeting decision at hand.

## 6.2 Cash Flows for a Replacement Project

In Section 5.1, we evaluated the cash flows for an expansion project, basing our after-tax cash flows on the outlays, annual operating cash flows after tax, and salvage value for the project by itself. In many cases, however, investing in a project will be more complicated. Investing could affect many of the company's cash flows. In principle, the cash flows relevant to an investing decision are the incremental cash flows: the cash flows the company realizes *with* the investment compared to the cash flows the company would realize *without* the investment. For example, suppose we are investing in a new project with an outlay of \$100,000 and we sell off existing assets that the project replaces for \$30,000. The incremental outlay is \$70,000.

A very common investment decision is a replacement decision, in which you replace old equipment with new equipment. This decision requires very careful analysis of the cash flows. The skills required to detail the replacement decision cash flows are also useful for other decisions in which an investment affects other cash flows in the company. We use the term "replacement" loosely, primarily to indicate that the cash flow analysis is more complicated than it was for the simpler expansion decision.

Assume we are considering the replacement of old equipment with new equipment that has more capacity and is less costly to operate. The characteristics of the old and new equipment are given below:

Old Equipment	New Equipment		
Current book value	\$400,000		
Current market value	\$600,000	Acquisition cost	\$1,000,000

Old Equipment	New Equipment		
Remaining life	10 years	Life	10 years
Annual sales	\$300,000	Annual sales	\$450,000
Cash operating expenses	\$120,000	Cash operating expenses	\$150,000
Annual depreciation	\$40,000	Annual depreciation	\$100,000
Accounting salvage value	\$0	Accounting salvage value	\$0
Expected salvage value	\$100,000	Expected salvage value	\$200,000

If the new equipment replaces the old equipment, an additional investment of \$80,000 in net working capital will be required. The tax rate is 30 percent, and the required rate of return is 8 percent.

The cash flows can be found by carefully constructing tables like Table 14 or by using Equations 6 through 9. The initial outlay is the investment in the new equipment plus the additional investment in net working capital less the after-tax proceeds from selling the old equipment:

$$\text{Outlay} = \text{FCInv} + \text{NWCInv} - \text{Sal}_0 + T(\text{Sal}_0 - B_0)$$

$$\text{Outlay} = 1,000,000 + 80,000 - 600,000 + 0.3(600,000 - 400,000) = \$540,000$$

In this case, the outlay of \$540,000 is \$1,080,000 for new equipment and net working capital minus the after-tax proceeds of \$540,000 the company receives from selling the old equipment. The incremental operating cash flows are

$$\begin{aligned} \text{CF} &= (S - C - D)(1 - T) + D \\ &= [(450,000 - 300,000) - (150,000 - 120,000) - (100,000 - 40,000)](1 - 0.30) \\ &\quad + (100,000 - 40,000) \\ &= (150,000 - 30,000 - 60,000)(1 - 0.30) + 60,000 = \$102,000 \end{aligned}$$

The incremental sales are \$150,000, incremental cash operating expenses are \$30,000, and incremental depreciation is \$60,000. The incremental after-tax operating cash flow is \$102,000 per year.

At the project termination, the new equipment is expected to be sold for \$200,000, which constitutes an incremental cash flow of \$100,000 over the \$100,000 expected salvage price of the old equipment. Since the accounting salvage values for both the new and old equipment were zero, this gain is taxable at 30 percent. The company also recaptures its investment in net working capital. The terminal year incremental after-tax non-operating cash flow is

$$\begin{aligned} \text{TNOCF} &= \text{Sal}_T + \text{NWCInv} - T(\text{Sal}_T - B_T) \\ &= (200,000 - 100,000) + 80,000 - 0.30[(200,000 - 100,000) - (0 - 0)] \\ &= \$150,000 \end{aligned}$$

Once the cash flows are identified, the NPV and IRR are readily found. The NPV, found by discounting the cash flows at the 8 percent required rate of return, is

$$\text{NPV} = -540,000 + \sum_{t=1}^{10} \frac{102,000}{1.08^t} + \frac{150,000}{1.08^{10}} = \$213,907$$

The IRR, found with a financial calculator, is 15.40 percent. Because the NPV is positive, this equipment replacement decision is attractive. The fact that the IRR exceeds the 8 percent required rate of return leads to the same conclusion.

The key to estimating the incremental cash flows for the replacement is to compare the cash flows that occur with the new investment to the cash flows that would have occurred without the new investment. The analyst is comparing the cash flows with a particular course of action to the cash flows with an alternative course of action.

### 6.3 Spreadsheet Modeling

Although the examples in this reading can be readily solved with a financial calculator, capital budgeting is usually done with the assistance of personal computers and spreadsheets such as Microsoft Excel®. Spreadsheets are heavily used for several reasons. Spreadsheets provide a very effective way of building even complex models. Built-in spreadsheet functions (such as those for finding rates of return) are easy to use. The model's assumptions can be changed and solved easily. Models can be shared with other analysts, and they also help in presenting the results of the analysis. The example below shows how a spreadsheet can be used to solve a capital budgeting problem.

#### EXAMPLE 7

#### Capital Budgeting with a Spreadsheet

Lawton Enterprises is evaluating a project with the following characteristics:

- Fixed capital investment is \$2,000,000.
  - The project has an expected six-year life.
  - The initial investment in net working capital is \$200,000. At the end of each year, net working capital must be increased so that the cumulative investment in net working capital is one-sixth of the next year's projected sales.
  - The fixed capital is depreciated 30 percent in Year 1, 35 percent in Year 2, 20 percent in Year 3, 10 percent in Year 4, 5 percent in Year 5, and 0 percent in Year 6.
  - Sales are \$1,200,000 in Year 1. They grow at a 25 percent annual rate for the next two years, and then grow at a 10 percent annual rate for the last three years.
  - Fixed cash operating expenses are \$150,000 for Years 1–3 and \$130,000 for Years 4–6.
  - Variable cash operating expenses are 40 percent of sales in Year 1, 39 percent of sales in Year 2, and 38 percent in Years 3–6.
  - Lawton's marginal tax rate is 30 percent.
  - Lawton will sell its fixed capital investments for \$150,000 when the project terminates and recapture its cumulative investment in net working capital. Income taxes will be paid on any gains.
  - The project's required rate of return is 12 percent.
  - If taxable income on the project is negative in any year, the loss will offset gains elsewhere in the corporation, resulting in a tax savings.
- 1 Determine whether this is a profitable investment using the NPV and IRR.
  - 2 If the tax rate increases to 40 percent and the required rate of return increases to 14 percent, is the project still profitable?

**Solution to 1:****Table 19 Cash Flows for Lawton Investment (Rounded to Nearest \$1,000)**

Year	0	1	2	3	4	5	6
Fixed capital investment	-2,000						
NWC investments	-200	-50	-63	-31	-34	-38	
Sales		1,200	1,500	1,875	2,063	2,269	2,496
Fixed cash expenses		150	150	150	130	130	130
Variable cash expenses		480	585	713	784	862	948
Depreciation		600	700	400	200	100	0
Operating income before taxes		-30	65	613	949	1,177	1,417
Taxes on operating income		-9	20	184	285	353	425
Operating income after taxes		-21	45	429	664	824	992
Add back: Depreciation		600	700	400	200	100	0
After-tax operating cash flow		579	745	829	864	924	992
Salvage value							150
Taxes on salvage value							-45
Return of NWC							416
Total after-tax cash flows	-2,200	529	682	798	830	886	1,513
NPV (at $r = 12$ percent)		1,181					
IRR			26.60%				

Because the NPV of \$1,181,000 is positive, the project is profitable for Lawton to undertake. The IRR investment decision rule also indicates that the project is profitable because the IRR of 26.60 percent exceeds the 12 percent required rate of return.

**Solution to 2:**

The tax rate and required return can be changed in the spreadsheet model. When these changes are made, the NPV becomes \$736,000 and the IRR becomes 24.02 percent. (The revised spreadsheet is not printed here.) Although profitability is lower, the higher tax rate and required rate of return do not change the investment decision.

## 6.4 Effects of Inflation on Capital Budgeting Analysis

Inflation affects capital budgeting analysis in several ways. The first decision the analyst must make is whether to do the analysis in “nominal” terms or in “real” terms. Nominal cash flows include the effects of inflation, while real cash flows are adjusted

downward to remove the effects of inflation. It is perfectly acceptable to do the analysis in either nominal or real terms, and sound decisions can be made either way. However, inflation creates some issues regardless of the approach.

The cash flows and discount rate used should both be nominal or both be real. In other words, nominal cash flows should be discounted at a nominal discount rate, and real cash flows should be discounted at a real rate. The real rate, just like real cash flows, has had the effect of inflation taken out. In general, the relationship between real and nominal rates is

$$(1 + \text{Nominal rate}) = (1 + \text{Real rate})(1 + \text{Inflation rate})$$

Inflation reduces the value of depreciation tax savings (unless the tax system adjusts depreciation for inflation). The effect of expected inflation is captured in the discounted cash flow analysis. If inflation is higher than expected, the profitability of the investment is correspondingly lower than expected. Inflation essentially shifts wealth from the taxpayer to the government. Higher-than-expected inflation increases the corporation's real taxes because it reduces the value of the depreciation tax shelter. Conversely, lower-than-expected inflation reduces real taxes (the depreciation tax shelters are more valuable than expected).

Inflation also reduces the value of fixed payments to bondholders. When bonds are originally issued, bondholders pay a price for the bonds reflecting their inflationary expectations. If inflation is higher than expected, the real payments to bondholders are lower than expected. Higher-than-expected inflation shifts wealth from bondholders to the issuing corporations. Conversely, if inflation is lower than expected, the real interest expenses of the corporation increase, shifting wealth from the issuing corporation to its bondholders.

Finally, inflation does not affect all revenues and costs uniformly. The company's after-tax cash flows will be better or worse than expected depending on how particular sales outputs or cost inputs are affected. Furthermore, contracting with customers, suppliers, employees, and sources of capital can be complicated as inflation rises.

The capital budgeting model accommodates the effects of inflation, although inflation complicates the capital budgeting process (and the operations of a business, in general).

## 7

# PROJECT ANALYSIS AND EVALUATION

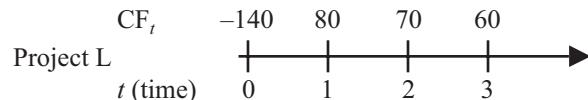
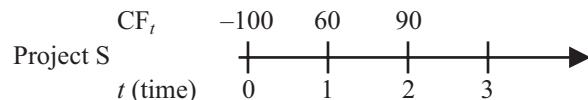
Assessing the opportunity costs and analyzing the risks of capital investments becomes more complex and sophisticated as you examine real cases. The first project interaction we examine in this section is that of comparing mutually exclusive projects with unequal lives. We will briefly describe other project interactions, but will not examine them in detail. We also examine the process of capital budgeting under capital rationing.

Up to this point, we have largely ignored the issue of accounting for risk. We will introduce risk analysis in two ways. The first is accounting for risk on a stand-alone basis. The second is accounting for risk on a systematic basis.

## 7.1 Mutually Exclusive Projects with Unequal Lives

We have previously looked at mutually exclusive projects and decided that the best project is the one with the greatest NPV. However, if the mutually exclusive projects have differing lives and the projects will be replaced (or replicated) repeatedly when they wear out, the analysis is more complicated. The analysis of a one-shot (one time only) investment differs from that of an investment chain (in which the asset is replaced regularly in the future).

For example, assume we have two projects with unequal lives of two and three years, with the following after-tax cash flows:



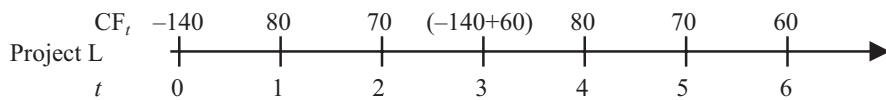
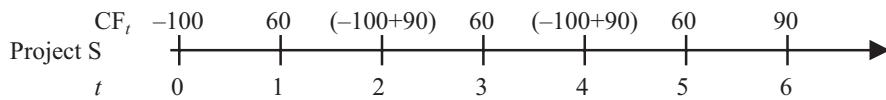
Both projects have a 10 percent required rate of return. The NPV of Project S is \$28.93 and the NPV of Project L is \$35.66. Given that the two projects are mutually exclusive, Project L, with the greater NPV, should be chosen.

However, let us now assume that these are not one-shot investments, but investments in assets that the company will need to replace when they wear out. Project S would be replaced every two years and Project L every three years. This situation is often referred to as a replacement chain. In this type of problem, you should examine the entire chain and not just the first link in the chain. If the projects are part of a replacement chain, examining the cash flows for only the initial investment for Projects S and L is improper because Project L provides cash flows during Year 3, when Project S provides none.

There are two logically equivalent ways of comparing mutually exclusive projects in a replacement chain. They are the “least common multiple of lives” approach and the “equivalent annual annuity” approach.

### 7.1.1 Least Common Multiple of Lives Approach

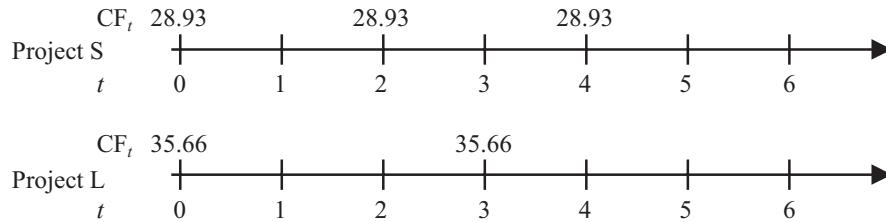
For the least common multiple of lives approach, the analyst extends the time horizon of analysis so that the lives of both projects will divide exactly into the horizon. For Projects S and L, the least common multiple of 2 and 3 is 6: The two-year project would be replicated three times over the six-year horizon and the three-year project would be replicated two times over the six-year horizon.<sup>9</sup> The cash flows for replicating Projects S and L over a six-year horizon are shown below.



Discounting the cash flows for the six-year horizon results in an NPV for Project S of \$72.59 and an NPV for Project L of \$62.45. Apparently, investing in Project S and replicating the investment over time has a greater NPV than choosing Project L and replicating it. This decision is the reverse of the one we made when looking solely at the NPVs of the initial investments!

Because the NPV of a single investment represents the present values of its cash flows, you can also visualize the NPV of a replacement chain as the present value of the NPVs of each investment (or link) in the chain. For Projects S and L, the NPVs of each investment are shown on the timelines below:

<sup>9</sup> The least common multiple of lives is not necessarily the product of the two lives, as in the case of Projects S and L. For example, if two projects have lives of 8 and 10 years, the least common multiple of lives is 40 years, not 80. Both 8 and 10 are exactly divisible into 40.



Investing in Project S is equivalent to receiving values of \$28.93 at times 0, 2, and 4, while investing in Project L is equivalent to receiving values of \$35.66 at times 0 and 3. The present values of these cash flow patterns are \$72.59 for Project S and \$62.45 for Project L. Discounting the NPVs of each investment in the chain is equivalent to discounting all of the individual cash flows in the chain.

### 7.1.2 Equivalent Annual Annuity Approach

The other method for properly evaluating a replacement chain is called the equivalent annual annuity (EAA) approach. The name for this approach is very descriptive. For an investment project with an outlay and variable cash flows in the future, the project NPV summarizes the equivalent value at time zero. For this same project, the EAA is the annuity payment (series of equal annual payments over the project's life) that is equivalent in value to the NPV.

Analysts can use a simple two-step procedure to find the EAA. The first step is to find the present value of all of the cash flows for an investment—the investment's NPV. The second step is to calculate an annuity payment that has a value equivalent to the NPV. For Project S above, we already calculated the NPV of the project over its two-year life to be \$28.93. The second step is to find an annuity payment for the two-year life that is equivalent. For a two-year life and a 10 percent discount rate, a payment of \$16.66 is the equivalent annuity.

The EAA for Project L is found by annuitizing its \$35.66 NPV over three years, so the EAA for Project L is \$14.34.

The decision rule for the EAA approach is to choose the investment chain that has the highest EAA, which in this case is Project S.

Given these two approaches to comparing replacement chains, which one should the analyst use? As a practical matter, the two approaches are logically equivalent and will result in the same decision.<sup>10</sup> Consequently, the analyst can choose one approach over the other based on personal preference. Or, if the audience for the analyst's work prefers to see the analysis using one approach, the analyst can simply produce the analysis in that format.

## 7.2 Capital Rationing

Capital rationing is the case in which the company's capital budget has a size constraint. For example, the capital budget is a fixed money amount. A fixed capital budget can place the company in several interesting situations. To illustrate these, we will assume that the company has a fixed \$1,000 capital budget and has the opportunity to invest in four projects. The projects are of variable profitability.

In the first situation, the budget is adequate to invest in all profitable projects. Consider the four projects in Table 20.

<sup>10</sup> For Projects S and L, the NPVs of a replacement chain over the least common multiple of lives (six years) were \$72.59 for Project S and \$62.45 for Project L. If we discount the EAA for Project S (\$16.66) and the EAA for Project L (\$14.34) for six years (treating each as a six-year annuity), we have the same NPVs. Hence, the least common multiple of lives and EAA approaches are consistent with each other.

**Table 20 First Capital Rationing Example**

	<b>Investment Outlay</b>	<b>NPV</b>	<b>PI</b>	<b>IRR (%)</b>
Project 1	600	220	1.37	15
Project 2	200	70	1.35	16
Project 3	200	-60	0.70	10
Project 4	400	-100	0.75	8

In this case, the company has two positive-NPV projects, Projects 1 and 2, which involve a total outlay of \$800. Their total NPV is \$290. The company should choose these projects, and it will have \$200 in its capital budget left over. These excess funds can be used elsewhere in the company (moved to someone else's budget, used to pay dividends or repurchase shares, or used to pay down debt). If a manager is afraid to return the excess funds and chooses to invest in Project 3, the manager will consume the whole capital budget but reduce the total NPV to \$230, essentially destroying \$60 of wealth for the company.

A second case exists in which the company has more profitable projects than it can choose, but it is able to invest in the most profitable ones available. Continuing with the \$1,000 capital budget, this second case is illustrated in Table 21.

**Table 21 Second Capital Rationing Example**

	<b>Investment Outlay</b>	<b>NPV</b>	<b>PI</b>	<b>IRR (%)</b>
Project 5	600	300	1.50	16
Project 6	200	80	1.40	18
Project 7	200	60	1.30	12
Project 8	200	40	1.20	14

When the analyst has a fixed budget, the PI is especially useful because it shows the profitability of each investment per currency unit invested. If we rank these projects by their PIs, Projects 5, 6, and 7 are the best projects and we are able to select them. This selection results in a total NPV of \$440. The IRRs, shown in the last column, are not a reliable guide to choosing projects under capital rationing because a high-IRR project may have a low NPV. Wealth maximization is best guided by the NPV criterion.

A third case exists in which the company has more profitable projects than it can choose, but it is not able to invest in the most profitable ones available. Assume the company cannot invest in fractional projects: It must take all or none of each project it chooses. Continuing with the \$1,000 capital budget, this case is illustrated in Table 22.

**Table 22 Third Capital Rationing Example**

	<b>Investment Outlay</b>	<b>NPV</b>	<b>PI</b>	<b>IRR (%)</b>
Project 9	600	300	1.50	15
Project 10	600	270	1.45	16
Project 11	200	80	1.40	12
Project 12	400	100	1.25	11

In this example, an unlimited budget of \$1,800 would generate a total NPV of \$750. However, when the budget constraint is imposed, the highest NPV results from choosing Projects 9 and 12. The company is forced to choose its best project and its fourth-best project, as indicated by their relative PIs. Any other combination of projects either violates the budget or has a lower total NPV.

Capital rationing has the potential to misallocate resources. Capital markets are supposed to allocate funds to their highest and best uses, with the opportunity cost of funds (used as the discount rate for NPVs or the hurdle rate for IRRs) guiding this allocation process. Capital rationing violates market efficiency if society's resources are not allocated where they will generate the best returns. Companies that use capital rationing may be doing either "hard" or "soft" capital rationing. Under hard capital rationing, the budget is fixed and the managers cannot go beyond it. Under soft capital rationing, managers may be allowed to over-spend their budgets if they argue effectively that the additional funds will be deployed profitably.

In the case of hard rationing, choosing the optimal projects that fit within the budget and maximize the NPV of the company can be computationally intensive. Sometimes, managers use estimates and trial and error to find the optimal set of projects. The PI can be used as a guide in this trial and error process. Other times, the number of possibilities is so daunting that mathematical programming algorithms are used.

### 7.3 Risk Analysis of Capital Investments—Stand-Alone Methods

So far, we have evaluated projects by calculating a single NPV to decide whether a project is profitable. We took a single value, or point estimate, of each input into the model and combined the values to calculate the NPV.

Risk is usually measured as a dispersion of outcomes. In the case of stand-alone risk, we typically measure the riskiness of a project by the dispersion of its NPVs or the dispersion of its IRRs. Sensitivity analysis, scenario analysis, and simulation analysis are very popular stand-alone risk analysis methods. These risk measures depend on the variation of the project's cash flows.

To illustrate the stand-alone risk tools, we will use the following "base case" capital project:

Unit price	\$5.00
Annual unit sales	40,000
Variable cost per unit	\$1.50
Investment in fixed capital	\$300,000
Investment in working capital	\$50,000
Project life	6 years
Depreciation (straight-line)	\$50,000
Expected salvage value	\$60,000
Tax rate	40 percent
Required rate of return	12 percent

The outlay, from Equation 6, is \$300,000 plus \$50,000, or \$350,000. The annual after-tax operating cash flow, from Equation 7, is

$$\begin{aligned}
 CF &= (S - C - D)(1 - T) + D \\
 &= [(5 \times 40,000) - (1.50 \times 40,000) - (50,000)](1 - 0.40) + 50,000 \\
 &= \$104,000
 \end{aligned}$$

The terminal year after-tax non-operating cash flow, from Equation 9, is

$$\begin{aligned} \text{TNOCF} &= \text{Sal}_6 + \text{NWCInv} - \text{T}(\text{Sal}_6 - \text{B}_6) \\ &= 60,000 + 50,000 - 0.40(60,000 - 0) = \$86,000 \end{aligned}$$

The project NPV is

$$\text{NPV} = -350,000 + \sum_{t=1}^6 \frac{104,000}{1.12^t} + \frac{86,000}{1.12^6} = -350,000 + 471,157 = \$121,157$$

### 7.3.1 Sensitivity Analysis

Sensitivity analysis calculates the effect on the NPV of changes in one input variable at a time. The base case above has several input variables. If we wish to do a sensitivity analysis of several of them, we must specify the changes in each that we wish to evaluate. Suppose we want to consider the following:

	<b>Base Value</b>	<b>Low Value</b>	<b>High Value</b>
Unit price	\$5.00	\$4.50	\$5.50
Annual unit sales	40,000	35,000	45,000
Variable cost per unit	\$1.50	\$1.40	\$1.60
Expected salvage value	\$60,000	\$30,000	\$80,000
Tax rate	40%	38%	42%
Required rate of return	12%	10%	14%

We have changed each of six input variables. Table 23 shows the NPV calculated for the base case. Then the NPV is recalculated by changing one variable from its base case value to its high or low value.

**Table 23 Sensitivity of Project NPV to Changes in a Variable**

<b>Variable</b>	<b>Project NPV</b>			
	<b>Base Case (\$)</b>	<b>With Low Estimate (\$)</b>	<b>With High Estimate (\$)</b>	<b>Range of Estimates (\$)</b>
Unit price	121,157	71,820	170,494	98,674
Annual unit sales	121,157	77,987	164,326	86,339
Cost per unit	121,157	131,024	111,289	19,735
Salvage value	121,157	112,037	127,236	15,199
Tax rate	121,157	129,165	113,148	16,017
Required return	121,157	151,492	93,602	57,890

As Table 23 shows, the project's NPV is most sensitive to changes in the unit price variable. The project's NPV is least sensitive to changes in the salvage value. Roughly speaking, the project's NPV is most sensitive to changes in unit price and in unit sales. It is least affected by changes in cost per unit, salvage value, and the tax rate. Changes in the required rate of return also have a substantial effect, but not as much as changes in price or unit sales.

In a sensitivity analysis, the manager can choose which variables to change and by how much. Many companies have access to software that can be instructed to change a particular variable by a certain amount—for example, to increase or decrease unit

price, unit sales, and cost per unit by 10 percent. The software then produces the changes in NPV for each of these changes. Sensitivity analysis can be used to establish which variables are most influential on the success or failure of a project.

### 7.3.2 Scenario Analysis

Sensitivity analysis calculates the effect on the NPV of changes in one variable at a time. In contrast, scenario analysis creates scenarios that consist of changes in several of the input variables and calculates the NPV for each scenario. Although corporations could do a large number of scenarios, in practice they usually do only three. They can be labeled variously, but we will present an example with “pessimistic,” “most likely,” and “optimistic” scenarios. Continuing with the basic example from the section above, the values of the input variables for the three scenarios are given in the table below.

**Table 24 Input Variables and NPV for Scenario Analysis**

<b>Variable</b>	<b>Scenario</b>		
	<b>Pessimistic</b>	<b>Most Likely</b>	<b>Optimistic</b>
Unit price	\$4.50	\$5.00	\$5.50
Annual unit sales	35,000	40,000	45,000
Variable cost per unit	\$1.60	\$1.50	\$1.40
Investment in fixed capital	\$320,000	\$300,000	\$280,000
Investment in working capital	\$50,000	\$50,000	\$50,000
Project life	6 years	6 years	6 years
Depreciation (straight-line)	\$53,333	\$50,000	\$46,667
Salvage value	\$40,000	\$60,000	\$80,000
Tax rate	40%	40%	40%
Required rate of return	13%	12%	11%
NPV	-\$5,725	\$121,157	\$269,685
IRR	12.49%	22.60%	34.24%

The most likely scenario is the same as the base case we used above for sensitivity analysis, and the NPV for the most likely scenario is \$121,157. To form the pessimistic and optimistic scenarios, managers change several of the assumptions for each scenario. For the pessimistic scenario, several of the input variables are changed to reflect higher costs, lower revenues, and a higher required rate of return. As the table shows, the result is a negative NPV for the pessimistic scenario and an IRR that is less than the pessimistic scenario's 13 percent required rate of return. For the optimistic scenario, the more favorable revenues, costs, and required rate of return result in very good NPV and IRR.

For this example, the scenario analysis reveals the possibility of an unprofitable investment, with a negative NPV and with an IRR less than the cost of capital. The range for the NPV is fairly large compared to the size of the initial investment, which indicates that the investment is fairly risky. This example included three scenarios for which management wants to know the profitability of the investment for each set of assumptions. Other scenarios can be investigated if management chooses to do so.

### 7.3.3 *Simulation (Monte Carlo) Analysis*

Simulation analysis is a procedure for estimating a probability distribution of outcomes, such as for the NPV or IRR for a capital investment project. Instead of assuming a single value (a point estimate) for the input variables in a capital budgeting spreadsheet, the analyst can assume several variables to be stochastic, following their own probability distributions. By simulating the results hundreds or thousands of times, the analyst can build a good estimate of the distributions for the NPV or IRR. Because of the volume of computations, analysts and corporate managers rely heavily on their personal computers and specialized simulation software such as @RISK.<sup>11</sup> Example 8 presents a simple simulation analysis.

#### EXAMPLE 8

### Capital Budgeting Simulation

Gouhua Zhang has made the following assumptions for a capital budgeting project:

- Fixed capital investment is 20,000; no investment in net working capital is required.
  - The project has an expected five-year life.
  - The fixed capital is depreciated straight-line to zero over a five-year life. The salvage value is normally distributed with an expected value of 2,000 and a standard deviation of 500.
  - Unit sales in Year 1 are normally distributed with a mean of 2,000 and a standard deviation of 200.
  - Unit sales growth after Year 1 is normally distributed with a mean of 6 percent and standard deviation of 4 percent. Assume the same sales growth rate for Years 2–5.
  - The sales price is 5.00 per unit, normally distributed with a standard deviation of 0.25 per unit. The same price holds for all five years.
  - Cash operating expenses as a percentage of total revenue are normally distributed with a mean and standard deviation of 30 percent and 3 percent, respectively.
  - The discount rate is 12 percent and the tax rate is 40 percent.
- 1 What are the NPV and IRR using the expected values of all input variables?
  - 2 Perform a simulation analysis and provide probability distributions for the NPV and IRR.

<sup>11</sup> @RISK is a popular and powerful risk analysis tool sold by Palisade Corporation. @RISK is an add-in for Microsoft Excel that allows simulation techniques to be incorporated into spreadsheet models.

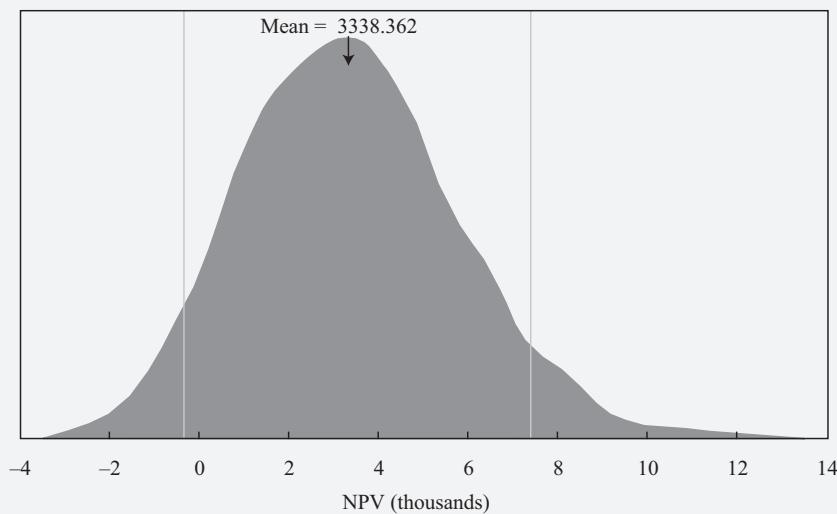
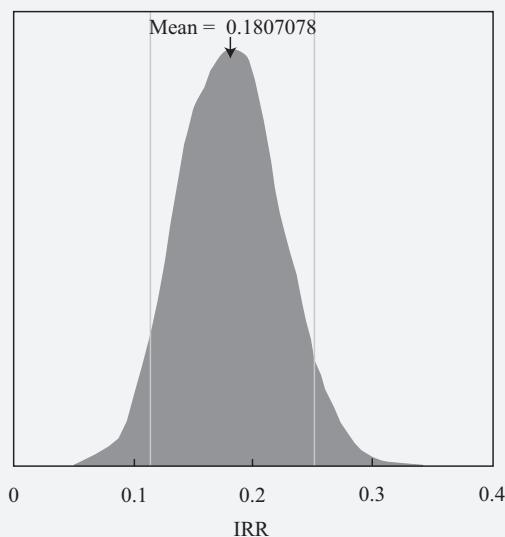
**Solution to 1:****Table 25 Expected Cash Flows for Simulation Example**

Time	0	1	2	3	4	5
Fixed capital	-20,000					
After-tax salvage value						1,200
Price		5.00	5.00	5.00	5.00	5.00
Output	2,000	2,120	2,247	2,382	2,525	
Revenue	10,000	10,600	11,236	11,910	12,625	
Cash operating expenses	3,000	3,180	3,371	3,573	3,787	
Depreciation	4,000	4,000	4,000	4,000	4,000	
Operating income before taxes	3,000	3,420	3,865	4,337	4,837	
Taxes on operating income	1,200	1,368	1,546	1,735	1,935	
Operating income after taxes	1,800	2,052	2,319	2,602	2,902	
Depreciation	4,000	4,000	4,000	4,000	4,000	
Total after-tax cash flow	-20,000	5,800	6,052	6,319	6,602	8,102
NPV (at $r = 12$ percent)		3,294				
IRR		18.11%				

Based on the point estimates for each variable (the mean values for each), which are shown in Table 25 above, Zhang should find the NPV to be 3,294 and the IRR to be 18.11 percent.

**Solution to 2:**

Zhang performs a simulation using @RISK with 10,000 iterations. For each iteration, values for the five stochastic variables (price, output, output growth rate, cash expense percentage, and salvage value) are selected from their assumed distributions and the NPV and IRR are calculated. After the 10,000 iterations, the resulting information about the probability distributions for the NPV and IRR is shown in Figure 6 and Table 26.

**Figure 6A Distribution for NPV****Figure 6B Distribution for IRR****Table 26 Summary Statistics for NPV and IRR**

<b>Statistic</b>	<b>NPV</b>	<b>IRR</b>
Mean	3,338	18.07%
Standard deviation	2,364	4.18%
Skewness	0.2909	0.1130
Kurtosis	3.146	2.996
Median	3,236	18.01%
90% confidence interval	-379 to 7,413	11.38% to 25.13%

*(continued)*

**Table 26 (Continued)**

Correlations between Input Variables and NPV and IRR		
Input Variable	NPV	IRR
Output	0.71	0.72
Output growth rate	0.49	0.47
Price	0.34	0.34
Cash expense proportion	-0.28	-0.29
Salvage value	0.06	0.05

As the figure shows, the distributions for the NPV and IRR are somewhat normal looking. The means and standard deviations for each are given in Table 26. Both distributions have a slight positive skewness, which means the distributions are skewed to the right. The two kurtosis values are fairly close to 3.0, which means that the distributions are not peaked or fat-tailed compared to the standard normal distribution. The median is the value at which 50 percent of the 10,000 outcomes fall on either side. The 90 percent confidence intervals show that 90 percent of the observations fall between -379 and 7,413 for the NPV and between 11.38 percent and 25.13 percent for the IRR. Although not shown in the table, 7.04 percent of the observations had a negative NPV and an IRR less than the 12 percent discount rate.

The means of the NPV and IRR from the simulation (in Table 26) are fairly close to their values calculated using point estimates for all of the input variables (in Table 25). This is not always the case, but it is here. The additional information from a simulation is the dispersions of the NPV and IRR. Given his assumptions and model, the simulation results show Zhang the distributions of NPV and IRR outcomes that should be expected. Managers and analysts often prefer to know these total distributions rather than just their mean values.

The correlations in Table 26 can be interpreted as sensitivity measures. Changes in the “output” variable have the highest correlation with NPV and IRR outcomes. The salvage value has the lowest (absolute value) correlation.

This capital budgeting simulation example was not very complex, with only five stochastic variables. The example’s five input variables were assumed to be normally distributed—in reality, many other distributions can be employed. Finally, the randomly chosen values for each variable were assumed to be independent. They can be selected jointly instead of independently. Simulation techniques have proved to be a boon for addressing capital budgeting problems.

Sensitivity analysis, scenario analysis, and simulation analysis are well-developed stand-alone risk analysis methods. These risk measures depend on the variation of the project’s cash flows. Market risk measures, presented in the next section, depend not only on the variation of a project’s cash flows, but also on how those cash flows covary with (or correlate with) market returns.

## 7.4 Risk Analysis of Capital Investments—Market Risk Methods

When using market risk methods, the discount rate to be used in evaluating a capital project is the rate of return required on the project by a diversified investor. The discount rate should thus be a risk-adjusted discount rate, which includes a premium to compensate investors for risk.<sup>12</sup> This risk premium should reflect factors that are priced or valued in the marketplace. The two equilibrium models for estimating this risk premium are the capital asset pricing model (CAPM) and arbitrage pricing theory (APT). We will discuss the CAPM as a way of finding risk-adjusted discount rates, although you should be aware that other methods can be used.

In the CAPM, total risk can be broken into two components: systematic risk and unsystematic risk. Systematic risk is the portion of risk that is related to the market and that cannot be diversified away. Unsystematic risk is non-market risk, risk that is idiosyncratic and that can be diversified away. Diversified investors can demand a risk premium for taking systematic risk, but not unsystematic risk.<sup>13</sup> Hence, the stand-alone risk measures—total risk measured by the dispersion of the NPV or the IRR—are inappropriate when the corporation is diversified, or, as is more likely, when the corporation's investors are themselves diversified.

In the capital asset pricing model, a project's or asset's "beta," or  $\beta$ , is generally used as a measure of systematic risk. The security market line (SML) expresses the asset's required rate of return as a function of  $\beta$ :

$$r_i = R_F + \beta_i [E(R_M) - R_F] \quad (10)$$

where

$r_i$  = required return for project or asset *i*

$R_F$  = risk-free rate of return

$\beta_i$  = beta of project or asset *i*

$[E(R_M) - R_F]$  = market risk premium, the difference between the expected market return and the risk-free rate of return

The project's required rate of return is equal to the risk-free rate plus a risk premium, where the risk premium is the product of the project beta and the market risk premium.

Here, the required rate of return (sometimes called a hurdle rate) is specific to the risk of the project and assumes the project is 100% equity financed. There is no one hurdle rate appropriate for all projects.

The security market line (SML) is graphed in Figure 7. This line indicates the required rate of return for a project, given its beta. The required rate of return can be used in two ways:

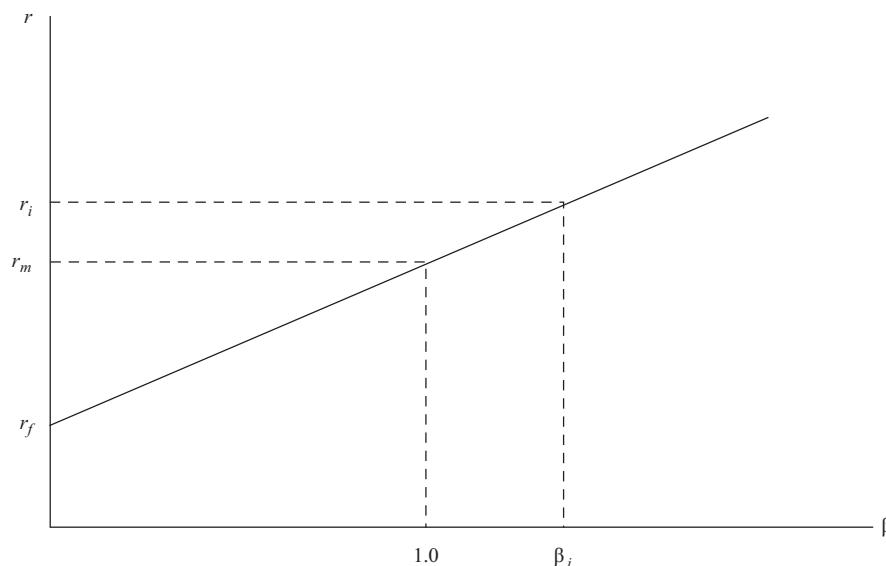
- The SML is used to find the required rate of return. The required rate of return is then used to find the NPV. Positive NPV projects are accepted and negative NPV projects are rejected.

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<sup>12</sup> Our approach to capital budgeting is to discount expected cash flows at a risk-adjusted cost of capital. An alternative approach, which is also conceptually sound, is the "certainty-equivalent method." In this method, certainty-equivalent cash flows (expected cash flows that are reduced to certainty equivalents) are valued by discounting them at a risk-free discount rate. The use of risk-adjusted discount rates is more intuitive and much more popular.

<sup>13</sup> The capital asset pricing model uses this intuition to show how risky assets should be priced relative to the market. While the CAPM assigns a single market risk premium for each security, the APT develops a set of risk premia. The CAPM and APT are discussed in detail in Level I of the CFA Program curriculum.

- The SML is used to find the required rate of return. The project's IRR is compared to the required rate of return. If the IRR is greater than the required return, the project is accepted (this point would plot above the SML in Figure 7). If the IRR is less than the required rate of return (below the SML), the project is rejected.

**Figure 7 SML for Capital Budgeting Projects**

Example 9 illustrates how the capital asset pricing model and the security market line are used as part of the capital budgeting process.

#### EXAMPLE 9

#### Using the SML to Find the Project Required Rate of Return

Premont Systems is evaluating a capital project with the following characteristics:

- The initial outlay is €150,000 all financed by equity.
- Annual after-tax operating cash flows are €28,000.
- After-tax salvage value at project termination is €20,000.
- Project life is 10 years.
- The project beta is 1.20.
- The risk-free rate is 4.2 percent and the expected market return is 9.4 percent.

- Compute the project NPV. Should the project be accepted?
- Compute the project IRR. Should the project be accepted?

#### Solution to 1:

The project's required rate of return is

$$\begin{aligned} r_i &= R_F + \beta_i[E(R_M) - R_F] = 4.2\% + 1.20(9.4\% - 4.2\%) \\ &= 4.2\% + 6.24\% = 10.44\% \end{aligned}$$

The cash flows discounted at 10.44 percent give an NPV of

$$\text{NPV} = -150,000 + \sum_{t=1}^{10} \frac{28,000}{1.1044^t} + \frac{20,000}{1.1044^{10}} = €26,252$$

The project should be accepted because it has a positive NPV.

### **Solution to 2:**

The IRR, found with a financial calculator, is 14.24 percent. The required rate of return, established with the SML as in the solution to Question 1 above, is 10.44 percent. Since the IRR exceeds the required rate of return, the project should be accepted. For a beta of 1.20, the IRR of 14.24 percent would plot above the SML.

Using project betas to establish required rates of return for capital projects is especially important when a project's risk differs from that of the company. The cost of capital for a company is estimated for the company as a whole—it is based on the average riskiness of the company's assets as well as its financial structure. The required rates of return of debt and equity are used to estimate the weighted (overall) average cost of capital (WACC) for the company. When a project under consideration is more risky or less risky than the company, the WACC should not be used as the project's required rate of return.

For example, assume that the risk-free rate of return is 3 percent, the market return is 8 percent, the company capital structure is 100% equity, and the company beta is 0.9. Assume also that the company is considering three projects each to be financed entirely by equity: Project A with a 0.5 beta, Project B with a 0.9 beta, and Project C with a 1.1 beta. The required rates of return for the company and for each project are as follows:

Company	$3\% + 0.9(8\% - 3\%) = 7.5\%$
Project A	$3\% + 0.5(8\% - 3\%) = 5.5\%$
Project B	$3\% + 0.9(8\% - 3\%) = 7.5\%$
Project C	$3\% + 1.1(8\% - 3\%) = 8.5\%$

If management uses the company WACC as the required return for all projects, this rate is too high for Project A, making it less likely that Project A would be accepted. Project B has the same risk as the company, so it would be evaluated fairly. Using the WACC for Project C makes the error of using a discount rate that is too low, which would make it more likely that this high-risk project would be accepted. Whenever possible, it is desirable to use project-specific required rates of return instead of the company's overall required rate of return.

Market returns are readily available for publicly traded companies. The stock betas of these companies can then be calculated, and this calculation assists in estimating the companies' betas and WACC. Unfortunately, however, the returns for specific capital projects are not directly observable, and we have to use proxies for their betas. Frequently, we can employ the pure-play method, in which the analyst identifies other publicly traded stocks in the same business as the project being considered. The betas for the stocks of these companies are used to estimate a project beta. In the pure-play method, these proxy companies need to be relatively focused in the same line of business as the project. When the pure-play method is not possible, other methods, such as estimating accounting betas or cross-sectional regression analysis, are used.

## 7.5 Real Options

Real options are capital budgeting options that allow managers to make decisions in the future that alter the value of capital budgeting investment decisions made today. Instead of making all capital budgeting decisions now, at time zero, managers can wait and make additional decisions at future dates when these future decisions are contingent upon future economic events or information. These sequential decisions, in which future decisions depend on the decisions made today as well as on future economic events, are very realistic capital budgeting applications.

Real options are like financial options—they just deal with real assets instead of financial assets. A simple financial option could be a call option on a share of stock. Suppose the stock is selling for \$50, the exercise (strike) price is \$50, and the option expires in one year. If the stock goes up to \$60, you exercise the option and have a gain of \$10 in one year. If the stock goes down to \$40, you do not exercise, and you have no gain. However, no gain is better than the \$10 loss you would have had if you had purchased the stock at the beginning of the year. Real options, like financial options, entail the right to make a decision, but not the obligation. The corporation should exercise a real option only if it is value-enhancing.

Just as financial options are contingent on an underlying asset, real options are contingent on future events. The flexibility that real options give to managers can greatly enhance the NPV of the company's capital investments. The following are several types of these real options:

**Timing Options** Instead of investing now, the company can delay investing. Delaying an investment and basing the decision on hopefully improved information that you might have in, say, a year could help improve the NPV of the projects selected.

**Sizing Options** If after investing, the company can abandon the project when the financial results are disappointing, it has an **abandonment option**. At some future date, if the cash flow from abandoning a project exceeds the present value of the cash flows from continuing the project, managers should exercise the abandonment option. Conversely, if the company can make additional investments when future financial results are strong, the company has a **growth option** or an expansion option.

**Flexibility Options** Once an investment is made, other operational flexibilities may be available besides abandonment or expansion. For example, suppose demand exceeds capacity. Management may be able to exercise a **price-setting option**. By increasing prices, the company could benefit from the excess demand, which it cannot do by increasing production. There are also **production-flexibility** options. Even though it is expensive, the company can profit from working overtime or from adding additional shifts. The company can also work with customers and suppliers for their mutual benefit whenever a demand-supply mismatch occurs. This type of option also includes the possibility of using different inputs or producing different outputs.

**Fundamental Options** In cases like those above, there are options embedded in a project that can raise its value. In other cases, the whole investment is essentially an option. The payoffs from the investment are contingent on an underlying asset, just like most financial options. For example, the value of an oil well or refinery investment is contingent upon the price of oil. The value of a gold mine is contingent upon the price of gold. If oil prices are low, you may not drill a well. If oil prices are high, you go ahead and drill. Many R&D (research and development) projects also look like options.

There are several approaches to evaluating capital budgeting projects with real options. One of the difficulties with real options is that the analysis can be very complicated. Although some of the problems are simple and can be readily solved, many

of them are so complex that they are expensive to evaluate or you may not have much confidence in the analysis. Four common sense approaches to real options analysis are presented below.

- 1 Use DCF analysis without considering options. If the NPV is positive without considering real options, and the project has real options that would simply add more value, it is unnecessary to evaluate the options. Just go ahead and make the investment.
- 2 Consider the Project NPV = NPV(based on DCF alone) – Cost of options + Value of options. Go ahead and calculate the NPV based on expected cash flows. Then simply add the value associated with real options. For example, if a project has a negative NPV based on DCF alone of \$50 million, will the options add at least that much to its value?
- 3 Use decision trees. Although they are not as conceptually sound as option pricing models, decision trees can capture the essence of many sequential decision making problems.
- 4 Use option pricing models. Except for simple options, the technical requirements for solving these models may require you to hire special consultants or “quants.” Some large companies have their own specialists.

The analyst is confronted with 1) a variety of real options that investment projects may possess and 2) a decision about how to reasonably value these options. Example 10 deals with production flexibility; in this case, an additional investment outlay gives the company an option to use alternative fuel sources.

#### **EXAMPLE 10**

#### **Production-Flexibility Option**

Sackley AquaFarms estimated the NPV of the expected cash flows from a new processing plant to be -\$0.40 million. Sackley is evaluating an incremental investment of \$0.30 million that would give management the flexibility to switch between coal, natural gas, and oil as an energy source. The original plant relied only on coal. The option to switch to cheaper sources of energy when they are available has an estimated value of \$1.20 million. What is the value of the new processing plant including this real option to use alternative energy sources?

#### **Solution:**

The NPV, including the real option, should be

$$\text{Project NPV} = \text{NPV (based on DCF alone)} - \text{Cost of options} + \\ \text{Value of options}$$

$$\begin{aligned}\text{Project NPV} &= -0.40 \text{ million} - 0.30 \text{ million} + 1.20 \text{ million} \\ &= \$0.50 \text{ million}\end{aligned}$$

Without the flexibility offered by the real option, the plant is unprofitable. The real option to adapt to cheaper energy sources adds enough to the value of this investment to give it a positive NPV.

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Two of the most valuable options are to abandon or expand a project at some point after the original investment. Example 11 illustrates the abandonment option.

**EXAMPLE 11****Abandonment Option**

Nyberg Systems is considering a capital project with the following characteristics:

- The initial outlay is €200,000.
  - Project life is four years.
  - Annual after-tax operating cash flows have a 50 percent probability of being €40,000 for the four years and a 50 percent probability of being €80,000.
  - Salvage value at project termination is zero.
  - The required rate of return is 10 percent.
  - In one year, after realizing the first-year cash flow, the company has the option to abandon the project and receive the salvage value of €150,000.
- 1 Compute the project NPV assuming no abandonment.
  - 2 What is the optimal abandonment strategy? Compute the project NPV using that strategy.

**Solution to 1:**

The expected annual after-tax operating cash flow is  $0.50(40,000) + 0.50(80,000) = €60,000$ . The cash flows discounted at 10 percent give an NPV of

$$\text{NPV} = -200,000 + \sum_{t=1}^4 \frac{60,000}{1.10^t} = -€9,808$$

The project should be rejected because it has a negative NPV.

**Solution to 2:**

The optimal abandonment strategy would be to abandon the project in one year if the subsequent cash flows are worth less than the abandonment value. If at the end of the first year the low cash flow occurs, you can abandon for €150,000 and give up €40,000 for the following three years. The €40,000 annual cash flow, discounted for three years at 10 percent, has a present value of only €99,474, so you should abandon. Three years of the higher €80,000 cash flow has a present value of €198,948, so you should not abandon. After the first year, abandon if the low cash flow occurs, and do not abandon if the high cash flow occurs.

If the high cash flow occurs and you do not abandon, the NPV is

$$\text{NPV} = -200,000 + \sum_{t=1}^4 \frac{80,000}{1.10^t} = €53,589$$

If you abandon when the low cash flow occurs, you receive the first year cash flow and the abandonment value and then no further cash flows. In that case, the NPV is

$$\text{NPV} = -200,000 + \frac{40,000 + 150,000}{1.10} = -€27,273$$

The expected NPV is then

$$\text{NPV} = 0.50(53,589) + 0.50(-27,273) = €13,158$$

Optimal abandonment raises the NPV by  $13,158 - (-€9,808) = €22,966$ .

A fundamental real option could be a gold mine or an oil well. Example 12 looks at the possibility of purchasing the rights to a gold mining property.

### EXAMPLE 12

#### Erichmann Gold Mine

The Erichmann family has offered a five-year option on one of its small gold mining properties for \$10 million. The current price of gold is \$400 per ounce. The mine holds an estimated 500,000 ounces that could be mined at an average cost of \$450 per ounce. The maximum production rate is 200,000 ounces per year. How would you assess the Erichmann family's offer?

#### Solution:

A binomial option model can be built for the underlying price of gold. These binomial models are very common in assessing the value of financial options such as puts and calls on stocks, callable bonds, or mortgages with prepayment options. Whenever the price path for gold is above \$450 per ounce, it might be attractive to commence mining. Of course, you would cease mining whenever the price is lower. With additional information about the volatility of gold prices and the risk-free interest rate, an expert could build this binomial model and value the real option. Comparing the value of this real option to its \$10 million cost would enable you to make an investment decision.

A critical assumption of many applications of traditional capital budgeting tools is that the investment decision is made now, with no flexibility considered in future decisions. A more reasonable approach is to assume that the corporation is making sequential decisions, some now and some in the future. A combination of optimal current and future decisions is what will maximize company value. Real options analysis tries to incorporate rational future decisions into the assessment of current investment decision making. This future flexibility, exercised intelligently, enhances the value of capital investments. Some real options can be valued with readily available option pricing models, such as the binomial model or the Black–Scholes–Merton option pricing model.<sup>14</sup> Unfortunately, many real options are very complex and hard to value, which poses a challenge as the analyst tries to lay out the economic contingencies of an investment and assess their values. A real option, with the future flexibility it provides, can be an important piece of the value of many projects.

## 7.6 Common Capital Budgeting Pitfalls

Although the principles of capital budgeting may be easy to learn, applying the principles to real world investment opportunities can be challenging. Some of the common mistakes that managers make are listed in Table 27.

**Table 27 Common Capital Budgeting Pitfalls**

Not incorporating economic responses into the investment analysis

Misusing capital budgeting templates

*(continued)*

<sup>14</sup> Option pricing models are discussed in detail in the Level II CFA Program reading “Valuation of Contingent Claims.”

**Table 27 (Continued)**

- Pet projects
  - Basing investment decisions on EPS, net income, or return on equity
  - Using IRR to make investment decisions
  - Bad accounting for cash flows
  - Overhead costs
  - Not using the appropriate risk-adjusted discount rate
  - Spending all of the investment budget just because it is available
  - Failure to consider investment alternatives
  - Handling sunk costs and opportunity costs incorrectly
- 

**Economic Responses** Economic responses to an investment often affect its profitability, and these responses have to be correctly anticipated. For example, in response to a successful investment, competitors can enter and reduce the investment's profitability. Similarly, vendors, suppliers, and employees may want to gain from a profitable enterprise. Companies that make highly profitable investments often find that a competitive marketplace eventually causes profitability to revert to normal levels.

**Template Errors** Because hundreds or even thousands of projects need to be analyzed over time, corporations have standardized capital budgeting templates for managers to use in evaluating projects. This situation creates risks in that the template model may not match the project, or employees may input inappropriate information.

**Pet Projects** **Pet projects** are projects that influential managers want the corporation to invest in. Ideally, pet projects will receive the normal scrutiny that other investments receive and will be selected on the strength of their own merits. Often, unfortunately, pet projects are selected without undergoing normal capital budgeting analysis. Or the pet project receives the analysis, but overly optimistic projections are used to inflate the project's profitability.

**EPS, Net Income, or ROE** Managers sometimes have incentives to boost EPS, net income, or ROE. Many investments, even those with strong NPVs, do not boost these accounting numbers in the short run and may even reduce them. Paying attention to short-run accounting numbers can result in choosing projects that are not in the long-run economic interests of the business.

**Basing Decisions on the IRR** The NPV criterion is economically sound. The IRR criterion is also sound for independent projects (with conventional cash flow patterns). If projects are mutually exclusive or competitive with each other, investing in projects based on the IRR will tend to result in choosing smaller, short-term projects with high IRRs at the expense of larger, longer-term, high NPV projects. Basing decisions on paybacks or accounting rates of return is even more dangerous. These measures can be economically unsound.

**Bad Accounting for Cash Flows** In analyzing a complicated project, it is easy to omit relevant cash flows, double count cash flows, and mishandle taxes.

**Overhead Costs** In large companies, the cost of a project must include the overhead it generates for such things as management time, information technology support, financial systems, and other support. Although these items are hard to estimate, over- or underestimating these overhead costs can lead to poor investment decisions.

**Discount Rate Errors** The required rate of return for a project should be based on its risk. If a project is being financed with debt (or with equity), you should still use the project's required rate of return and not the cost of debt (or the **cost of equity**). Similarly, a high-risk project should not be discounted at the company's overall cost of capital, but at the project's required rate of return. Discount rate errors have a huge impact on the computed NPVs of long-lived projects.

**Overspending and Underspending the Capital Budget** Politically, many managers will spend all of their budget and argue that their budget is too small. In a well-run company, managers will return excess funds whenever their profitable projects cost less than their budget, and managers will make a sound case for extra funds if their budget is too small.

**Failure to Consider Investment Alternatives** Generating good investment ideas is the most basic step in the capital budgeting process, and many good alternatives are never even considered.

**Sunk Costs and Opportunity Costs** Ignoring sunk costs is difficult for managers to do. Furthermore, not identifying the economic alternatives (real and financial) that are the opportunity costs is probably the biggest failure in much analysis. Only costs that change with the decision are relevant.

## OTHER INCOME MEASURES AND VALUATION MODELS

8

Capital budgeting was one of the first widespread applications of discounted cash flow analysis. In the basic capital budgeting model, the analyst values an investment by discounting future after-tax cash flows at the rate of return required by investors. Subtracting the initial investment results in the project's NPV. The future cash flows consist of after-tax operating cash flows plus returns of investment (such as salvage value and sale of working capital).

Analysts will employ and encounter other concepts of income and other valuation approaches besides this basic capital budgeting model. Because some of these other approaches are economically sound and widely employed, we will briefly describe some of them here. By considering these approaches, you can see the distinguishing features of each approach and that they should result in consistent valuations (if they are used correctly).

To facilitate the comparison of income measures and valuation models, we will employ as an example a simple company (the Granite Corporation) that invests in one project. The company goes out of business when that project expires. After evaluating that project with the NPV and IRR capital budgeting models, we will examine that same project using the following alternative methods:

- economic income and accounting income;
- economic profit valuation;
- residual income valuation; and
- claims valuation.

Our purpose is to show how the various income measures and valuation methods are related to each other.

## 8.1 The Basic Capital Budgeting Model

The basic capital budgeting model (presented earlier) identifies the after-tax operating cash flows from an investment as well as non-operating cash flows (such as the initial investment or future recovery of invested capital or net working capital). Then, these cash flows are discounted at the required rate of return for the asset to establish the NPV.

The base-case capital budgeting project is the following. The company is going to invest \$150,000 and generate sales for the next five years as shown in Table 28. Variable cash operating expenses will be 50 percent of sales each year, and fixed cash operating expenses are \$20,000. Depreciation is straight-line to zero, \$30,000 per year with a zero book value at the end of five years. The income tax rate is 40 percent. Salvage value is \$10,000, which is taxable at 40 percent, leaving an after-tax salvage value of \$6,000 at the end of five years. The required rate of return is 10 percent.

**Table 28 Basic Capital Budgeting Example for Granite Corporation**

Year	0	1	2	3	4	5
Fixed capital investment	−150,000					
Sales		150,000	200,000	250,000	200,000	150,000
Variable cash expenses		75,000	100,000	125,000	100,000	75,000
Fixed cash expenses		20,000	20,000	20,000	20,000	20,000
Depreciation		30,000	30,000	30,000	30,000	30,000
Operating income before taxes		25,000	50,000	75,000	50,000	25,000
Taxes at 40 percent		10,000	20,000	30,000	20,000	10,000
Operating income after taxes		15,000	30,000	45,000	30,000	15,000
After-tax operating cash flow		45,000	60,000	75,000	60,000	45,000
Salvage value						10,000
Taxes on salvage value						4,000
After-tax salvage value						6,000
Total after-tax cash flow	−150,000	45,000	60,000	75,000	60,000	51,000
NPV (at $r = 10$ percent)	69,492					
IRR	26.27%					

The present value of the after-tax cash flows for Years 1-5 is \$219,492. Subtracting the investment of \$150,000 results in the NPV of \$69,492. The IRR for the investment is 26.27 percent.

## 8.2 Economic and Accounting Income

Economic income and accounting income differ from the after-tax operating cash flows used in the basic capital budgeting model.

Economic income is the profit realized from an investment. For a given year, economic income is the investment's after-tax cash flow plus the change in the market value:

$$\text{Economic income} = \text{Cash flow} + \text{Change in market value}$$

$$\begin{aligned}\text{Economic income} &= \text{Cash flow} + (\text{Ending market value} \\ &\quad - \text{Beginning market value})\end{aligned}$$

(11)

Or

$$\text{Economic income} = \text{Cash flow} - (\text{Beginning market value} - \text{Ending market value})$$

$$\text{Economic income} = \text{Cash flow} - \text{Economic depreciation}^{15}$$

For the Granite Corporation, the cash flows are already calculated in Table 28. The beginning market value at time zero is the present value of the future after-tax cash flows at the 10 percent required rate of return, or \$219,492. The market value at any future date is the present value of subsequent cash flows discounted back to that date. For the Granite Corporation, the cash flows, changes in market value, and economic incomes are shown in Table 29.

**Table 29 Economic Income for Granite Corporation**

Year	1	2	3	4	5
Beginning market value	219,492	196,441	156,086	96,694	46,364
Ending market value	196,441	156,086	96,694	46,364	0
Change in market value	-23,051	-40,356	-59,391	-50,331	-46,364
After-tax cash flow	45,000	60,000	75,000	60,000	51,000
Economic income	21,949	19,644	15,609	9,669	4,636
Economic rate of return	10%	10%	10%	10%	10%

In Year 1, the beginning value is \$219,492 and the ending value is \$196,441, so the change in value is -\$23,051. The economic income is the cash flow plus the change in value, or  $\$45,000 + (-\$23,051) = \$21,949$ . The economic income for Years 2–5 is found similarly. The economic rate of return is the year's economic income divided by its beginning market value. Notice that the economic rate of return is precisely 10 percent each year, which was the required rate of return on the project.

Accounting income for this company will differ from the economic income for two reasons. First, the accounting depreciation is based on the original cost of the investment (not the market value of the investment). Consequently, the accounting depreciation schedule does not follow the declines in the market value of an asset. Besides being based on accounting depreciation instead of economic depreciation, accounting net income is the after-tax income remaining after paying interest expenses on the company's debt obligations. In contrast, interest expenses are ignored when computing the economic income for an asset or the after-tax operating cash flows in the basic capital budgeting model. As explained in Section 3, the effects of financing

<sup>15</sup> These equations are conceptually identical because economic depreciation is the negative of the change in market value. For example, assume the cash flow is 10, the beginning market value is 30, and the ending market value is 25.  $\text{Cash flow} + \text{Change in market value} = \text{Cash flow} + (\text{Ending market value} - \text{Beginning market value}) = 10 + (25 - 30) = 5$ . Or,  $\text{Cash flow} - \text{Economic depreciation} = \text{Cash flow} - (\text{Beginning market value} - \text{Ending market value}) = 10 - (30 - 25) = 5$ .

costs are captured in the discount rate, not in the cash flows. In the capital budgeting model, if we included interest expenses in the cash flows, we would be double counting them.

To illustrate these differences, we will assume that the company borrows an amount equal to one-half of the value of the company, which is 50 percent of \$219,492, or \$109,746, and that it pays 8½ percent interest each year on the beginning balance. With a 40 percent tax rate, the after-tax interest cost is  $8\frac{1}{2}\% (1 - 0.40) = 5.0\%$ . Because the Granite Corporation has a five-year life, it does not need to borrow or retain earnings for the future, and all cash flows will be distributed to bondholders and stockholders. Granite will maintain a 50 percent debt/value ratio on the company's debt, so bondholders will receive 8½ percent interest on their beginning bond balance and the debt will also be amortized (paid down) whenever the value of the company goes down. Furthermore, after all operating costs, interest expenses, and taxes are paid, stockholders will receive all remaining cash flows each year as a cash dividend or share repurchase.<sup>16</sup>

The financial statements for the Granite Corporation are shown in Table 30.

**Table 30 Condensed Financial Statements for Granite Corporation**

Year	0	1	2	3	4	5
<i>Balance sheets:</i>						
Assets	150,000	120,000	90,000	60,000	30,000	0
Liabilities	109,746	98,221	78,043	48,347	23,182	0
Net worth	40,254	21,779	11,957	11,653	6,818	0
<i>Income statements:</i>						
Sales	150,000	200,000	250,000	200,000	150,000	
Variable cash expenses	75,000	100,000	125,000	100,000	75,000	
Fixed cash expenses	20,000	20,000	20,000	20,000	20,000	
Depreciation	30,000	30,000	30,000	30,000	30,000	
EBIT	25,000	50,000	75,000	50,000	25,000	
Interest expense	9,146	8,185	6,504	4,029	1,932	
EBT	15,854	41,815	68,496	45,971	23,068	
Taxes at 40 percent	6,342	16,726	27,399	18,388	9,227	
Net income before salvage	9,513	25,089	41,098	27,583	13,841	
After-tax salvage value					6,000	
Net income	9,513	25,089	41,098	27,583	19,841	
<i>Statements of cash flows:</i>						
<i>Operating cash flows:</i>						
Net income	9,513	25,089	41,098	27,583	19,841	
Depreciation	30,000	30,000	30,000	30,000	30,000	
Total	39,513	55,089	71,098	57,583	49,841	
<i>Financing cash flows:</i>						
Debt repayment	-11,525	-20,178	-29,696	-25,165	-23,182	
Dividends/repurchases	-27,987	-34,911	-41,402	-32,417	-26,659	
Total	-39,513	-55,089	-71,098	-57,583	-49,841	

<sup>16</sup> The assumptions may be unrealistic, but this is a very simple corporation.

**Table 30 (Continued)**

Year	0	1	2	3	4	5
<i>Investing cash flows</i>	0	0	0	0	0	0
Total cash flows	0	0	0	0	0	0

The income statement for financial reporting purposes differs from that used in the capital budgeting model because the interest on debt obligations is now taken out as an expense before arriving at net income. The book value of the company's assets is based on the original accounting cost minus accumulated accounting depreciation. Note that the liabilities and net worth are also declining in the balance sheet. The liabilities decline each year, reflecting the amounts that were paid annually to reduce the principal of the loan. Notice, also, that the net worth is declining. Normally, the net worth of a company increases because beginning equity is increased by net retentions—the excess of net income over dividends paid. In this case, the company is shrinking and going out of business in five years, so the distributions to shareholders (which can be either cash dividends or share repurchases) exceed net income and net worth declines. The amounts that are paid each year to reduce debt and for dividends/share repurchases are shown in the financing section of the statement of cash flows.

Accounting measures of performance also can differ from economic measures of performance. Table 31 repeats the economic income and accounting income from Tables 29 and 30. The table also shows the economic rate of return each year and two popular accounting measures of performance: the return on equity (ROE = Net income divided by Beginning equity) and return on assets (ROA = EBIT divided by Beginning assets).

**Table 31 Economic Income, Accounting Income, and Rates of Return for Granite Corporation**

Year	1	2	3	4	5
Economic income	21,949	19,644	15,609	9,669	4,636
Accounting income	9,513	25,089	41,098	27,583	19,841
Economic rate of return	10.00%	10.00%	10.00%	10.00%	10.00%
Return on equity (ROE)	23.63%	115.20%	343.71%	236.70%	291.00%
Return on assets (ROA)	16.67%	41.67%	83.33%	83.33%	83.33%

As Table 31 illustrates, economic and accounting incomes differ substantially. Over the five years, economic income is much less than accounting income, and the patterns certainly differ. In addition, the accounting rates of return, the ROE and ROA, for this admittedly unusual company are quite different from the economic rate of return.

### 8.3 Economic Profit, Residual Income, and Claims Valuation

Although the capital budgeting model is widely employed, analysts have used other procedures to divide up the cash flows from a company or project and then value them using discounted cash flow methods. We present three of these alternative models here: the economic profit model, the residual income model, and the claims valuation model. Used correctly, they are all consistent with the basic capital budgeting model and with each other.

### 8.3.1 Economic Profit

The first alternative method for measuring income and valuing assets is based on economic profit (EP).<sup>17</sup> Economic profit has been used in asset valuation as well as in performance measurement and management compensation. Its calculation is loosely as follows:

$$\text{EP} = \text{NOPAT} - \$\text{WACC} \quad (12)$$

where

$\text{EP}$  = economic profit

$\text{NOPAT}$  = net operating profit after tax =  $\text{EBIT} (1 - \text{Tax rate})$

$\text{EBIT}$  = operating income before taxes, or earnings before interest and taxes

$\$WACC$  = dollar cost of capital =  $\text{WACC} \times \text{Capital}$

$\text{WACC}$  = weighted average (or overall) cost of capital

Capital = investment

EP is a periodic measure of profit above and beyond the dollar cost of the capital invested in the project. The dollar cost of capital is the dollar return that the company must make on the project in order to pay the debt holders and the equity holders their respective required rates of return.<sup>18</sup>

For the Granite Corporation, for the first year, we have the following:

$$\text{NOPAT} = \text{EBIT}(1 - \text{Tax rate}) = 25,000(1 - 0.40) = \$15,000$$

$$\$WACC = \text{WACC} \times \text{Capital} = 10\% \times 150,000 = \$15,000$$

$$\text{EP} = \text{NOPAT} - \$WACC = 15,000 - 15,000 = \$0$$

Table 32 shows the EP for all five years for the Granite Corporation.

**Table 32 EP for Granite Corporation**

Year	1	2	3	4	5 <sup>b</sup>
Capital <sup>a</sup>	150,000	120,000	90,000	60,000	30,000
NOPAT	15,000	30,000	45,000	30,000	21,000
$\$WACC$	15,000	12,000	9,000	6,000	3,000
EP	0	18,000	36,000	24,000	18,000

<sup>a</sup> Depreciation is \$30,000 per year.

<sup>b</sup> The \$6,000 after-tax gain from salvage is included in NOPAT in Year 5.

EP is readily applied to valuation of an asset or a security. The NPV found by discounted cash flow analysis in the basic capital budgeting model will be equal to the present value of future EP discounted at the weighted average cost of capital.

$$\text{NPV} = \sum_{t=1}^{\infty} \frac{\text{EP}_t}{(1 + \text{WACC})^t} \quad (13)$$

**17 Economic Value Added** or EVA®, trademarked by the consulting firm Stern Stewart & Company, is a well-known commercial application of the economic profit approach. For example, see Stewart (1991).

**18** You have already studied the relationship between the required rate of return on the project or WACC (here 10 percent), the rate of return required by debtholders (here 8½ percent), and the rate of return required by equityholders (here 15 percent).

This NPV is also called the market value added (MVA).<sup>19</sup> So we have

$$\text{NPV} = \text{MVA} = \sum_{t=1}^{\infty} \frac{\text{EP}_t}{(1 + \text{WACC})^t} \quad (14)$$

Discounting the five years of EP for the Granite Corporation at the 10 percent WACC gives an NPV (and MVA) of \$69,492. The total value of the company (of the asset) is the original investment of \$150,000 plus the NPV of \$69,492, or \$219,492. The valuation using EP is the same as that found with the basic capital budgeting model.

### 8.3.2 Residual Income

Another method for estimating income and valuing an asset is the residual income method.<sup>20</sup> This method focuses on the returns to equity, where

$$\text{Residual income} = \text{Net income} - \text{Equity charge},$$

or

$$\text{RI}_t = \text{NI}_t - r_e B_{t-1} \quad (15)$$

where

$\text{RI}_t$  = residual income during period  $t$

$\text{NI}_t$  = net income during period  $t$

$r_e B_{t-1}$  = equity charge for period  $t$ , which is the required rate of return on equity,  $r_e$ , times the beginning-of-period book value of equity,  $B_{t-1}$

For the first year for the Granite Corporation, the net income is \$9,513. The beginning book value of equity is \$40,254 (from the balance sheet in Table 30), and the required rate of return on equity is 15 percent. Consequently, the residual income for Year 1 is:

$$\text{RI}_t = \text{NI}_t - r_e B_{t-1} = 9,513 - 0.15(40,254) = 9,513 - 6,038 = \$3,475$$

The residual income for all five years for Granite is shown in Table 33.

**Table 33 Residual Income for Granite Corporation**

Year	1	2	3	4	5 <sup>a</sup>
$\text{NI}_t$	9,513	25,089	41,098	27,583	19,841
$r_e B_{t-1}$	6,038	3,267	1,794	1,748	1,023
$\text{RI}_t$	3,475	21,822	39,304	25,835	18,818

<sup>a</sup> The \$6,000 after-tax gain from salvage is included in NI in Year 5.

Residual income, like EP, can also be applied to valuation of an asset or security. The NPV of an investment is the present value of future residual income discounted at the required rate of return on equity.

$$\text{NPV} = \sum_{t=1}^{\infty} \frac{\text{RI}_t}{(1 + r_e)^t} \quad (16)$$

<sup>19</sup> MVA is defined as the market value of the company minus the capital invested, which is an NPV.

<sup>20</sup> The residual income method is discussed in detail in the Level II CFA Program reading “Residual Income Valuation.”

Discounting the residual income for the Granite Corporation at the 15 percent required rate of return on equity gives an NPV of \$69,492. The total value of the company (of the asset) is the present value of the residual income, the original equity investment, plus the original debt investment:

PV of residual income	\$69,492
Equity investment	40,254
Debt investment	109,746
Total value	\$219,492

The value of the company is the original book value of its debt and equity plus the present value of the residual income (which is the project's NPV). Again, this is the same value we found with the basic capital budgeting model and with the EP model.

### 8.3.3 Claims Valuation

To value a company, the EP valuation approach essentially adds the present value of EP to the original investment. The residual income approach adds the present value of residual income to the original debt and equity investments in the company. Since the EP approach is from the perspective of all suppliers of capital, EP is discounted at the overall WACC. The residual income approach takes the perspective of equity investors, so residual income is discounted at the cost of equity.

The third and final alternative valuation approach that we present is to divide the operating cash flows between securityholder classes (in this example, debt and equity), and then value the debt and equity cash flows separately.

Balance Sheet		
Assets	Liabilities	
	Equity	

The basic capital budgeting approach is to value the asset, which is on the left-hand side of the balance sheet above. The claims valuation approach values the liabilities and equity, the claims against the assets, which are on the right-hand side of the balance sheet. The value of the claims should equal the value of the assets.

For the Granite Corporation, the cash flows to debtholders are the interest payments and principal payments. These are valued by discounting them at the cost of debt, which is 8½ percent. The cash flows to stockholders are the dividends and share repurchases, which are valued by discounting them at the 15 percent cost of equity. Table 34 lists the future cash flows for debt and equity.

**Table 34 Payments to Bondholders and Stockholders of Granite Corporation**

Year	1	2	3	4	5
Interest payments	9,146	8,185	6,504	4,029	1,932
Principal payments	11,525	20,178	29,696	25,165	23,182
Total debt payments	20,671	28,363	36,199	29,194	25,114
Equity distributions	27,987	34,911	41,402	32,417	26,659

The present value of the total debt payments, discounted at the cost of debt, is \$109,746. The value of the equity distributions, discounted at the cost of equity, is \$109,746. The total value of the company is the combined value of debt and equity, which is \$219,492.

In our example, the basic capital budgeting model, the economic profit model, the residual income model, and the claims valuation model all result in the same valuation of the company. In the real world, analysts must deal with many accounting complications. Some of these complications may include pension liability adjustments, valuations of marketable securities held, exchange rate gains and losses, and adjustments for leases, inventories, goodwill, deferred taxes, etc. In theory, all of the valuation models are equivalent. In practice, even with due diligence and care, analysts may prefer one approach over others and disagree about valuations.

There are other approaches to valuation that analysts use and run across. Two common ones are the free cash flow to the firm and **free cash flow to equity** approaches.<sup>21</sup> The free cash flow to the firm approach is fundamentally the same as the basic capital budgeting approach. The free cash flow to equity approach is related to the claims valuation approach. In corporate finance, corporate managers usually value an asset by valuing its total after-tax cash flows. Security analysts typically value equity by valuing the cash flows to stockholders. Real estate investors often evaluate real estate investments by valuing the cash flows to the equity investor after payments to creditors, which is like the claims valuation approach.

## SUMMARY

Capital budgeting is the process that companies use for decision making on capital projects—those projects with a life of a year or more. This reading developed the principles behind the basic capital budgeting model, the cash flows that go into the model, and several extensions of the basic model.

- Capital budgeting undergirds the most critical investments for many corporations—their investments in long-term assets. The principles of capital budgeting have been applied to other corporate investing and financing decisions and to security analysis and portfolio management.
- The typical steps in the capital budgeting process are: 1) generating ideas, 2) analyzing individual proposals, 3) planning the capital budget, and 4) monitoring and post-auditing.
- Projects susceptible to capital budgeting process can be categorized as: 1) replacement, 2) expansion, 3) new products and services, and 4) regulatory, safety and environmental.
- Capital budgeting decisions are based on incremental after-tax cash flows discounted at the opportunity cost of funds. Financing costs are ignored because both the cost of debt and the cost of other capital are captured in the discount rate.
- The net present value (NPV) is the present value of all after-tax cash flows, or

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1+r)^t}$$

where the investment outlays are negative cash flows included in the  $CF_t$ s and where  $r$  is the required rate of return for the investment.

OPTIONAL  
SEGMENT

<sup>21</sup> The free cash flow to the firm and free cash flow to equity approaches are discussed in detail in the Level II CFA Program reading "Free Cash Flow Valuation."

- The IRR is the discount rate that makes the present value of all future cash flows sum to zero. This equation can be solved for the IRR:

$$\sum_{t=0}^n \frac{CF_t}{(1 + IRR)^t} = 0$$

- The payback period is the number of years required to recover the original investment in a project. The payback is based on cash flows.
- The discounted payback period is the number of years it takes for the cumulative discounted cash flows from a project to equal the original investment.
- The average accounting rate of return (AAR) can be defined as follows:

$$AAR = \frac{\text{Average net income}}{\text{Average book value}}$$

- The profitability index (PI) is the present value of a project's future cash flows divided by the initial investment:

$$PI = \frac{\text{PV of future cash flows}}{\text{Initial investment}} = 1 + \frac{\text{NPV}}{\text{Initial investment}}$$

- The capital budgeting decision rules are to invest if the  $NPV > 0$ , if the  $IRR > r$ , or if the  $PI > 1.0$ . There are no decision rules for the payback period, discounted payback period, and AAR because they are not always sound measures.
- The NPV profile is a graph that shows a project's NPV graphed as a function of various discount rates.
- For mutually exclusive projects that are ranked differently by the NPV and IRR, it is economically sound to choose the project with the higher NPV.
- The “multiple IRR problem” and the “no IRR problem” can arise for a project with nonconventional cash flows—cash flows that change signs more than once during the project’s life.
- The fact that projects with positive NPVs theoretically increase the value of the company and the value of its stock could explain the popularity of NPV as an evaluation method.
- Analysts often organize the cash flows for capital budgeting in tables, summing all of the cash flows occurring at each point in time. These totals are then used to find an NPV or IRR. Alternatively, tables collecting cash flows by type can be used. Equations for the capital budgeting cash flows are as follows:

Initial outlay:

$$\text{Outlay} = FCInv + NWCInv - Sal_0 + T(Sal_0 - B_0)$$

Annual after-tax operating cash flow:

$$CF = (S - C - D)(1 - T) + D, \text{ or}$$

$$CF = (S - C)(1 - T) + TD$$

Terminal year after-tax non-operating cash flow:

$$TNOCF = Sal_T + NWCInv - T(Sal_T - B_T)$$

- Depreciation schedules affect taxable income, taxes paid, and after-tax cash flows, and therefore capital budgeting valuations.
- Spreadsheets are heavily used for capital budgeting valuation.
- When inflation exists, the analyst should perform capital budgeting analysis in “nominal” terms if cash flows are nominal and in “real” terms if cash flows are real.

- Inflation reduces the value of depreciation tax savings (unless the tax system adjusts depreciation for inflation). Inflation reduces the value of fixed payments to bondholders. Inflation usually does not affect all revenues and costs uniformly. Contracting with customers, suppliers, employees, and sources of capital can be complicated as inflation rises.
- Two ways of comparing mutually exclusive projects in a replacement chain are the “least common multiple of lives” approach and the “equivalent annual annuity” approach.
- For the least common multiple of lives approach, the analyst extends the time horizon of analysis so that the lives of both projects will divide exactly into the horizon. The projects are replicated over this horizon, and the NPV for the total cash flows over the least common multiple of lives is used to evaluate the investments.
- The equivalent annual annuity is the annuity payment (series of equal annual payments over the project’s life) that is equivalent in value to the project’s actual cash flows. Analysts find the present value of all of the cash flows for an investment (the NPV) and then calculate an annuity payment that has a value equivalent to the NPV.
- With capital rationing, the company’s capital budget has a size constraint. Under “hard” capital rationing, the budget is fixed. In the case of hard rationing, managers use trial and error and sometimes mathematical programming to find the optimal set of projects. In that situation, it is best to use the NPV or PI valuation methods.
- Sensitivity analysis calculates the effect on the NPV of changes in one input variable at a time.
- Scenario analysis creates scenarios that consist of changes in several of the input variables and calculates the NPV for each scenario.
- Simulation (Monte Carlo) analysis is used to estimate probability distributions for the NPV or IRR of a capital project. Simulations randomly select values for stochastic input variables and then repeatedly calculate the project NPV and IRR to find their distributions.
- Risk-adjusted discount rates based on market risk measures should be used as the required rate of return for projects when the investors are diversified. The capital asset pricing model (CAPM) and arbitrage pricing theory (APT) are common approaches for finding market-based risk-adjusted rates.
- In the CAPM, a project’s or asset’s beta, or  $\beta$ , is used as a measure of systematic risk. The security market line (SML) estimates the asset’s required rate of return as  $r_i = R_F + \beta_i [E(R_M) - R_F]$ .
- Project-specific betas should be used instead of company betas whenever the risk of the project differs from that of the company.
- Real options can be classified as 1) timing options; 2) sizing options, which can be abandonment options or growth (expansion) options; 3) flexibility options, which can be price-setting options or production-flexibility options; and 4) fundamental options. Simple options can be evaluated with decision trees; for more complex options, the analyst should use option pricing models.
- Economic income is the investment’s after-tax cash flow plus the change in the market value. Accounting income is revenues minus expenses. Accounting depreciation, based on the original cost of the investment, is the decrease in the book (accounting) value, while economic depreciation is the decrease in the

market value of the investment. Accounting net income is net of the after-tax interest expenses on the company's debt obligations. In computing economic income, financing costs are ignored.

- Economic profit is

$$EP = NOPAT - \$WACC$$

where NOPAT = Net operating profit after tax = EBIT(1 – Tax rate) and \$WACC = Dollar cost of capital = WACC × Capital. When applied to the valuation of an asset or security, the NPV of an investment (and its market value added) is the present value of future EP discounted at the weighted average cost of capital.

$$NPV = MVA = \sum_{t=1}^{\infty} \frac{EP_t}{(1 + WACC)^t}$$

The total value of the company (of the asset) is the original investment plus the NPV.

- Residual income = Net income – Equity charge, or  $RI_t = NI_t - r_e B_{t-1}$  where  $RI_t$  = Residual income during period  $t$ ,  $NI_t$  = Net income during period  $t$ ,  $r_e$  = Cost of equity, and  $B_{t-1}$  = Beginning-of-period book value of equity. The NPV of an investment is the present value of future residual income discounted at the required rate of return on equity:

$$NPV = \sum_{t=1}^{\infty} \frac{RI_t}{(1 + r_e)^t}$$

The total value of the company (of the asset) is the NPV plus the original equity investment plus the original debt investment.

- The claims valuation approach values an asset by valuing the claims against the asset. For example, an asset financed with debt and equity has a value equal to the value of the debt plus the value of the equity.

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## PRACTICE PROBLEMS

- 1 FITCO is considering the purchase of new equipment. The equipment costs \$350,000, and an additional \$110,000 is needed to install it. The equipment will be depreciated straight-line to zero over a five-year life. The equipment will generate additional annual revenues of \$265,000, and it will have annual cash operating expenses of \$83,000. The equipment will be sold for \$85,000 after five years. An inventory investment of \$73,000 is required during the life of the investment. FITCO is in the 40 percent tax bracket and its cost of capital is 10 percent. What is the project NPV?
  - A \$52,122.
  - B \$64,090.
  - C \$97,449.
- 2 After estimating a project's NPV, the analyst is advised that the fixed capital outlay will be revised upward by \$100,000. The fixed capital outlay is depreciated straight-line over an eight-year life. The tax rate is 40 percent and the required rate of return is 10 percent. No changes in cash operating revenues, cash operating expenses, or salvage value are expected. What is the effect on the project NPV?
  - A \$100,000 decrease.
  - B \$73,325 decrease.
  - C \$59,988 decrease.
- 3 When assembling the cash flows to calculate an NPV or IRR, the project's after-tax interest expenses should be subtracted from the cash flows for:
  - A the IRR calculation, but not the NPV calculation.
  - B both the NPV calculation and the IRR calculation.
  - C neither the NPV calculation nor the IRR calculation.
- 4 Standard Corporation is investing \$400,000 of fixed capital in a project that will be depreciated straight-line to zero over its ten-year life. Annual sales are expected to be \$240,000, and annual cash operating expenses are expected to be \$110,000. An investment of \$40,000 in net working capital is required over the project's life. The corporate income tax rate is 30 percent. What is the after-tax operating cash flow expected in year one?
  - A \$63,000.
  - B \$92,000.
  - C \$103,000.
- 5 Five years ago, Frater Zahn's Company invested £38 million—£30 million in fixed capital and another £8 million in working capital—in a bakery. Today, Frater Zahn's is selling the fixed assets for £21 million and liquidating the investment in working capital. The book value of the fixed assets is £15 million and the marginal tax rate is 40 percent. The fifth year's after-tax non-operating cash flow to Frater Zahn's is closest to:
  - A £20.6 million.
  - B £23.0 million.
  - C £26.6 million.

## The following information relates to Questions 6–8

McConachie Company is considering the purchase of a new 400-ton stamping press. The press costs \$360,000, and an additional \$40,000 is needed to install it. The press will be depreciated straight-line to zero over a five-year life. The press will generate no additional revenues, but it will reduce cash operating expenses by \$140,000 annually. The press will be sold for \$120,000 after five years. An inventory investment of \$60,000 is required during the life of the investment. McConachie is in the 40 percent tax bracket.

- 6 What is the McConachie net investment outlay?
    - A \$400,000.
    - B \$420,000.
    - C \$460,000.
  - 7 McConachie's incremental annual after-tax operating cash flow is *closest* to:
    - A \$116,000.
    - B \$124,000.
    - C \$140,000.
  - 8 What is the terminal year after-tax non-operating cash flow at the end of year five?
    - A \$108,000.
    - B \$132,000.
    - C \$180,000.
- 

## The following information relates to Questions 9–14

Linda Pyle is head of analyst recruiting for PPA Securities. She has been very frustrated by the number of job applicants who, in spite of their stellar pedigrees, seem to have little understanding of basic financial concepts. Pyle has written a set of conceptual questions and simple problems for the human resources department to use to screen for the better candidates in the applicant pool. A few of her corporate finance questions and problems are given below.

- Concept 1 “A company invests in depreciable assets, financed partly by issuing fixed-rate bonds. If inflation is lower than expected, the value of the real tax savings from depreciation and the value of the real after-tax interest expense are both reduced.”
- Concept 2 “Sensitivity analysis and scenario analysis are useful tools for estimating the impact on a project’s NPV of changing the value of one capital budgeting input variable at a time.”
- Concept 3 “When comparing two mutually exclusive projects with unequal lives, the IRR is a good approach for choosing the better project because it does not require equal lives.”
- Concept 4 “Project-specific betas should be used instead of company betas whenever the risk of the project differs from that of the company.”

**Problem** “Fontenot Company is investing €100 in a project that is being depreciated straight-line to zero over a two-year life with no salvage value. The project will generate earnings before interest and taxes of €50 each year for two years. Fontenot’s weighted average cost of capital and required rate of return for the project are both 12 percent, and its tax rate is 30 percent.”

- 9** For Concept 1, the statement is correct regarding the effects on:
    - A** the real tax savings from depreciation, but incorrect regarding the real after-tax interest expense.
    - B** both the real tax savings from depreciation and the real after-tax interest expense.
    - C** neither the real tax savings from depreciation nor the real after-tax interest expense.
  - 10** For Concept 2, the statement is correct regarding:
    - A** sensitivity analysis, but not correct regarding scenario analysis.
    - B** scenario analysis, but not correct regarding sensitivity analysis.
    - C** both sensitivity analysis and scenario analysis.
  - 11** Are the statements identified as Concept 3 and Concept 4 correct?
    - A** No for Concepts 3 and 4.
    - B** No for Concept 3, but yes for Concept 4.
    - C** Yes for Concept 3, but no for Concept 4.
  - 12** The after-tax operating cash flows in euros for the Fontenot Company are:
    - A** 50 in both years.
    - B** 70 in both years.
    - C** 85 in both years.
  - 13** The economic income in euros for the Fontenot Company is:
    - A** 17.24 in Year 1 and 9.11 in Year 2.
    - B** 17.76 in Year 1 and 24.89 in Year 2.
    - C** 24.89 in Year 1 and 17.76 in Year 2.
  - 14** The market value added (MVA) in euros for the Fontenot Company is *closest* to:
    - A** 38.87.
    - B** 39.92.
    - C** 43.65.
- 

## The following information relates to Questions 15–20

The capital budgeting committee for Laroche Industries is meeting. Laroche is a North American conglomerate that has several divisions. One of these divisions, Laroche Livery, operates a large fleet of vans. Laroche’s management is evaluating whether it is optimal to operate new vans for two, three, or four years before replacing them. The managers have estimated the investment outlay, annual after-tax operating expenses, and after-tax salvage cash flows for each of the service lives. Because revenues and

some operating costs are unaffected by the choice of service life, they were ignored in the analysis. Laroche Livery's opportunity cost of funds is 10 percent. The following table gives the cash flows in thousands of Canadian dollars (C\$).

Service Life	Investment	Year 1	Year 2	Year 3	Year 4	Salvage
2 years	–40,000	–12,000	–15,000			20,000
3 years	–40,000	–12,000	–15,000	–20,000		17,000
4 years	–40,000	–12,000	–15,000	–20,000	–25,000	12,000

Schoeman Products, another division of Laroche, has evaluated several investment projects and now must choose the subset of them that fits within its C\$40 million capital budget. The outlays and NPVs for the six projects are given below. Schoeman cannot buy fractional projects, and must buy all or none of a project. The currency amounts are in millions of Canadian dollars.

Project	Outlay	PV of Future Cash Flows	NPV
1	31	44	13
2	15	21	6
3	12	16.5	4.5
4	10	13	3
5	8	11	3
6	6	8	2

Schoeman wants to determine which subset of the six projects is optimal.

A final proposal comes from the division Society Services, which has an investment opportunity with a real option to invest further if conditions warrant. The crucial details are as follows:

- The original project:
  - An outlay of C\$190 million at time zero.
  - Cash flows of C\$40 million per year for Years 1–10 if demand is “high.”
  - Cash flows of C\$20 million per year for Years 1–10 if demand is “low.”
- Additional cash flows with the optional expansion project:
  - An outlay of C\$190 million at time one.
  - Cash flows of C\$40 million per year for Years 2–10 if demand is “high.”
  - Cash flows of C\$20 million per year for Years 2–10 if demand is “low.”
- Whether demand is “high” or “low” in Years 1–10 will be revealed during the first year. The probability of “high” demand is 0.50, and the probability of “low” demand is 0.50.
- The option to make the expansion investment depends on making the initial investment. If the initial investment is not made, the option to expand does not exist.
- The required rate of return is 10 percent.

Society Services wants to evaluate its investment alternatives.

The internal auditor for Laroche Industries has made several suggestions for improving capital budgeting processes at the company. The internal auditor's suggestions are as follows:

Suggestion 1 “In order to put all capital budgeting proposals on an equal footing, the projects should all use the risk-free rate for the required rate of return.”

- Suggestion 2 “Because you cannot exercise both of them, you should not permit a given project to have both an abandonment option and an expansion/growth option.”
- Suggestion 3 “When rationing capital, it is better to choose the portfolio of investments that maximizes the company NPV than the portfolio that maximizes the company IRR.”
- Suggestion 4 “Project betas should be used for establishing the required rate of return whenever the project’s beta is different from the company’s beta.”

- 15** What is the optimal service life for Laroche Livery’s fleet of vans?
- A Two years.  
B Three years.  
C Four years.
- 16** The optimal subset of the six projects that Schoeman is considering consists of Projects:
- A 1 and 5.  
B 2, 3, and 4.  
C 2, 4, 5, and 6.
- 17** What is the NPV (C\$ millions) of the original project for Society Services without considering the expansion option?
- A -6.11.  
B -5.66.  
C 2.33.
- 18** What is the NPV (C\$ millions) of the optimal set of investment decisions for Society Services including the expansion option?
- A 6.34.  
B 12.68.  
C 31.03.
- 19** Should the capital budgeting committee accept the internal auditor’s first and second suggestions, respectively?
- A No for Suggestions 1 and 2.  
B No for Suggestion 1 and Yes for Suggestion 2.  
C Yes for Suggestion 1 and No for Suggestion 2.
- 20** Should the capital budgeting committee accept the internal auditor’s third and fourth suggestions, respectively?
- A No for Suggestions 3 and 4.  
B Yes for Suggestions 3 and 4.  
C No for Suggestion 3 and Yes for Suggestion 4.
-

## The following information relates to Questions 21–26

Maximilian Böhm is reviewing several capital budgeting proposals from subsidiaries of his company. Although his reviews deal with several details that may seem like minutiae, the company places a premium on the care it exercises in making its investment decisions.

The first proposal is a project for Richie Express, which is investing \$500,000, all in fixed capital, in a project that will have operating income after taxes of \$20,000 and depreciation of \$40,000 each year for the next three years. Richie Express will sell the asset in three years, paying 30 percent taxes on any excess of the selling price over book value. The proposal indicates that a \$647,500 terminal selling price will enable the company to earn a 15 percent internal rate of return on the investment. Böhm doubts that this terminal value estimate is correct.

Another proposal concerns Gasup Company, which does natural gas exploration. A new investment has been identified by the Gasup finance department with the following projected cash flows:

- Investment outlays are \$6 million immediately and \$1 million at the end of the first year.
- After-tax operating cash flows are \$0.5 million at the end of the first year and \$4 million at the end of each of the second, third, fourth, and fifth years. In addition, an after-tax outflow occurs at the end of the five-year project that has not been included in the operating cash flows: \$5 million required for environmental cleanup.
- The required rate of return on natural gas exploration is 18 percent.

The Gasup analyst is unsure about the calculation of the NPV and the IRR because the outlay is staged over two years.

Finally, Dominion Company is evaluating two mutually exclusive projects: The Pinto grinder involves an outlay of \$100,000, annual after-tax operating cash flows of \$45,000, an after-tax salvage value of \$25,000, and a three-year life. The Bolten grinder has an outlay of \$125,000, annual after-tax operating cash flows of \$47,000, an after-tax salvage value of \$20,000, and a four-year life. The required rate of return is 10 percent. The net present value (NPV) and equivalent annual annuity (EAA) of the Pinto grinder are \$30,691 and \$12,341, respectively. Whichever grinder is chosen, it will have to be replaced at the end of its service life. The analyst is unsure about which grinder should be chosen.

Böhm and his colleague Beth Goldberg have an extended conversation about capital budgeting issues, including several comments listed below. Goldberg makes two comments about real options:

- Comment 1 “The abandonment option is valuable, but it should be exercised only when the abandonment value is above the amount of the original investment.”
- Comment 2 “If the cost of a real option is less than its value, this will increase the NPV of the investment project in which the real option is embedded.”

Böhm also makes several comments about specific projects under consideration:

- Comment A The land and building were purchased five years ago for \$10 million. This is the amount that should now be included in the fixed capital investment.”

- Comment B “We can improve the project’s NPV by using the after-tax cost of debt as the discount rate. If we finance the project with 100 percent debt, this discount rate would be appropriate.”
- Comment C “It is generally safer to use the NPV than the IRR in making capital budgeting decisions. However, when evaluating mutually exclusive projects, if the projects have conventional cash flow patterns and have the same investment outlays, it is acceptable to use either the NPV or IRR.”
- Comment D “You should not base a capital budgeting decision on its immediate impact on earnings per share (EPS).”

- 21** What terminal selling price is required for a 15 percent internal rate of return on the Richie project?
- A \$588,028.  
B \$593,771.  
C \$625,839.
- 22** The NPV and IRR, respectively, of the Gasup Company investment are *closest* to:
- A \$509,600 and 21.4%.  
B \$509,600 and 31.3%.  
C \$946,700 and 31.3%.
- 23** Of the two grinders that the Dominion Company is evaluating, Böhm should recommend the:
- A Bolten grinder because its NPV is higher than the Pinto grinder NPV.  
B Bolten grinder because its EAA is higher than the Pinto grinder EAA.  
C Pinto grinder because its EAA is higher than the Bolten grinder EAA.
- 24** Are Goldberg’s comments about real options correct?
- A No for Comment 1 and Comment 2.  
B No for Comment 1 and Yes for Comment 2.  
C Yes for Comment 1 and No for Comment 2.
- 25** Is Böhm most likely correct regarding Comment A about the \$10 million investment and Comment B about using the after-tax cost of debt?
- A No for both comments.  
B Yes for both comments.  
C No for Comment A and Yes for Comment B.
- 26** Is Böhm most likely correct regarding Comment C that it is acceptable to use either NPV or IRR and Comment D about the immediate impact on EPS?
- A No for both comments.  
B Yes for both comments.  
C No for Comment C and Yes for Comment D.

## The following information relates to Questions 27–32

Barbara Simpson is a sell-side analyst with Smith Riccardi Securities. Simpson covers the pharmaceutical industry. One of the companies she follows, Bayonne Pharma, is evaluating a regional distribution center. The financial predictions for the project are as follows:

- Fixed capital outlay is €1.50 billion.
- Investment in net working capital is €0.40 billion.
- Straight-line depreciation is over a six-year period with zero salvage value.
- Project life is 12 years.
- Additional annual revenues are €0.10 billion.
- Annual cash operating expenses are reduced by €0.25 billion.
- The capital equipment is sold for €0.50 billion in 12 years.
- Tax rate is 40 percent.
- Required rate of return is 12 percent.

Simpson is evaluating this investment to see whether it has the potential to affect Bayonne Pharma's stock price. Simpson estimates the NPV of the project to be €0.41 billion, which should increase the value of the company.

Simpson is evaluating the effects of other changes to her capital budgeting assumptions. She wants to know the effect of a switch from straight-line to accelerated depreciation on the company's operating income and the project's NPV. She also believes that the initial outlay might be much smaller than initially assumed. Specifically, she thinks the outlay for fixed capital might be €0.24 billion lower, with no change in salvage value.

When reviewing her work, Simpson's supervisor provides the following comments. "I note that you are relying heavily on the NPV approach to valuing the investment decision. I don't think you should use an IRR because of the multiple IRR problem that is likely to arise with the Bayonne Pharma project. However, the equivalent annual annuity would be a more appropriate measure to use for the project than the NPV. I suggest that you compute an EAA."

- 27 Simpson should estimate the after-tax operating cash flow for Years 1–6 and 7–12, respectively, to be *closest* to:
  - A €0.31 billion and €0.21 billion.
  - B €0.31 billion and €0.25 billion.
  - C €0.35 billion and €0.25 billion.
- 28 Simpson should estimate the initial outlay and the terminal year non-operating cash flow, respectively, to be *closest* to:
  - A €1.50 billion and €0.70 billion.
  - B €1.90 billion and €0.70 billion.
  - C €1.90 billion and €0.90 billion.
- 29 Is Simpson's estimate of the NPV of the project correct?
  - A Yes.
  - B No. The NPV is –€0.01 billion.
  - C No. The NPV is €0.34 billion.
- 30 A switch from straight-line to accelerated depreciation would:
  - A increase the NPV and decrease the first year operating income after taxes.

- B increase the first year operating income after taxes and decrease the NPV.  
 C increase both the NPV and first year operating income after taxes.
- 31 If the outlay is lower by the amount that Simpson suggests, the project NPV should increase by an amount *closest* to:  
 A €0.09 billion.  
 B €0.14 billion.  
 C €0.17 billion.
- 32 How would you evaluate the comments by Simpson's supervisor about not using the IRR and about using the EAA? The supervisor is:  
 A incorrect about both.  
 B correct about IRR and incorrect about EAA.  
 C incorrect about IRR and correct about EAA.
- 

## The following information relates to Questions 33–38

Mun Hoe Yip is valuing Pure Corporation. Pure is a simple corporation that is going out of business in five years, distributing its income to creditors and bondholders as planned in the financial statements below. Pure has a 19 percent cost of equity, 8 1/3 percent before-tax cost of debt, 12 percent weighted average cost of capital, and 40 percent tax rate, and it maintains a 50 percent debt/value ratio.

Yip is valuing the company using the basic capital budgeting method as well as other methods, such as EP, residual income, and claims valuation. Yip's research assistant, Linda Robinson, makes three observations about the analysis.

**Observation 1** “The present value of the company’s economic income should be equal to the present value of the cash flows in the basic capital budgeting approach.”

**Observation 2** “The economic income each year is equal to the cash flow minus the economic depreciation.”

**Observation 3** “The market value added is the present value of the company’s economic profit (EP), which equals the net worth of 77,973.”

Year	0	1	2	3	4	5
<b>Balance Sheets:</b>						
Assets	200,000	160,000	120,000	80,000	40,000	0
Liabilities	122,027	107,671	88,591	64,222	33,929	0
Net worth	77,973	52,329	31,409	15,778	6,071	0
<b>Income Statements:</b>						
Sales	180,000	200,000	220,000	240,000	200,000	
Variable cash expenses	90,000	100,000	110,000	120,000	100,000	
Fixed cash expenses	20,000	20,000	20,000	20,000	20,000	
Depreciation	40,000	40,000	40,000	40,000	40,000	
EBIT	30,000	40,000	50,000	60,000	40,000	
Interest expense	10,169	8,973	7,383	5,352	2,827	

(continued)

Year	0	1	2	3	4	5
EBT		19,831	31,027	42,617	54,648	37,173
Taxes at 40 percent		7,932	12,411	17,047	21,859	14,869
Net income before salvage		11,899	18,616	25,570	32,789	22,304
After-tax salvage value						12,000
Net income		11,899	18,616	25,570	32,789	34,304
<b>Statements of Cash Flows:</b>						
<b>Operating cash flows:</b>						
Net income		11,899	18,616	25,570	32,789	34,304
Depreciation		40,000	40,000	40,000	40,000	40,000
Total		51,899	58,616	65,570	72,789	74,304
<b>Financing cash flows:</b>						
Debt repayment		14,357	19,080	24,369	30,293	33,929
Dividends/repurchases		37,542	39,536	41,201	42,496	40,375
Total		-51,899	-58,616	-65,570	-72,789	-74,304
<b>Investing cash flows:</b>		0	0	0	0	0
<b>Total cash flows:</b>		0	0	0	0	0

33 Economic income during year one is *closest* to:

- A 23,186.
- B 29,287.
- C 46,101.

34 What is EP during Year 1?

- A -12,101.
- B -6,000.
- C 6,000.

35 What is residual income during Year 1?

- A -2,916.
- B 2,542.
- C 8,653.

36 What is the value of equity at time zero?

- A 44,055.
- B 77,973.
- C 122,027.

37 Are Robinson's first two observations, respectively, correct?

- A Yes for both observations.
- B No for the first and Yes for the second.
- C Yes for the first and No for the second.

38 Which of the following would be Yip's *most appropriate* response to Robinson's third observation?

- A The market value added is not equal to the present value of EP, although the market value of equity is equal to 122,027.

- B The market value added is equal to the present value of EP, which in this case is 44,055.
  - C The market value added is not equal to the present value of EP, and market value added is equal to 44,055.
- 

## The following information relates to Questions 39–44

Carlos Velasquez, CFA, is a financial analyst with Embelesado, S.A., a Spanish manufacturer of sailboats and sailing equipment. Velasquez is evaluating a proposal for Embelesado to build sailboats for a foreign competitor that lacks production capacity and sells in a different market. The sailboat project is perceived to have the same risk as Embelesado's other projects.

The proposal covers a limited time horizon—three years—after which the competitor expects to be situated in a new, larger production facility. The limited time horizon appeals to Embelesado, which currently has excess capacity but expects to begin its own product expansion in slightly more than three years.

Velasquez has collected much of the information necessary to evaluate this proposal in Exhibits 1 and 2.

### Exhibit 1 Selected Data for Sailboat Proposal (Currency Amounts in € Millions)

Initial fixed capital outlay	60
Annual contracted revenues	60
Annual operating costs	25
Initial working capital outlay (recovered at end of the project)	10
Annual depreciation expense (both book and tax accounting)	20
Economic life of facility (years)	3
Salvage (book) value of facility at end of project	0
Expected market value of facility at end of project	5

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### Exhibit 2 Selected Data for Embelesado, S.A.

Book value of long-term debt/total assets	28.6%
Book value of equity/total assets	71.4%
Market value of long-term debt/market value of company	23.1%
Market value of equity/market value of company	76.9%
Coupon rate on existing long-term debt	8.5%
Interest rate on new long-term debt	8.0%
Cost of equity	13.0%
Marginal tax rate	35.0%
Maximum acceptable payback period	2 years

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Velasquez recognizes that Embelesado is currently financed at its target capital structure and expects that the capital structure will be maintained if the sailboat project is undertaken. Embelesado's managers disagree, however, about the method that should be used to evaluate capital budgeting proposals.

One of Embelesado's vice presidents asks Velasquez the following questions:

- Question 1 Will projects that meet a corporation's payback criterion for acceptance necessarily have a positive net present value (NPV)?
- Question 2 For mutually exclusive projects, will the NPV and internal rate of return (IRR) methods necessarily agree on project ranking?
- Question 3 For the sailboat project, what will be the effects of using accelerated depreciation (for both book and tax accounting) instead of straight-line depreciation on a) the NPV and b) the total net cash flow in the terminal year?
- Question 4 Assuming a 13 percent discount rate, what will be the increase in the sailboat project's NPV if the expected market value of the facility at end of project is €15 million rather than €5 million?

**39** The weighted average cost of capital for Embelesado is *closest* to:

- A 10.78%.
- B 11.20%.
- C 11.85%.

**40** The total net cash flow (in € millions) for the sailboat project in its terminal year is *closest* to:

- A 33.00.
- B 39.75.
- C 43.00.

**41** The IRR for the sailboat project is *closest* to:

- A 18.5%.
- B 19.7%.
- C 20.3%.

**42** The best responses that Velasquez can make to Question 1 and Question 2 are:

	Question 1	Question 2
A	No	No
B	No	Yes
C	Yes	No

**43** In response to Question 3, what are the *most likely* effects on the NPV and the total net cash flow in the terminal year, respectively?

	NPV	Total Net Cash Flow in Terminal Year
A	Increase	Increase
B	Increase	Decrease
C	Decrease	Increase

**44** In response to Question 4, the increase in the sailboat project's NPV(in € millions) is *closest* to:

- A 4.50.

B 6.50.

C 6.76.

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## The following information relates to Questions 45–50

María Hernández is a sell-side analyst covering the electronics industry in Spain. One of the companies she follows, SG Electronics, S.A., has recently announced plans to begin producing and selling a new series of video cameras. Hernández estimates that this project will increase the value of the company and, consequently, she plans on changing her research opinion on the company from a “hold” to a “buy.” Her initial financial predictions for the project are:

- Fixed capital equipment outlay is €2,750,000.
- At the beginning of the project, a required increase in current assets of €200,000 and a required increase in current liabilities of €125,000.
- Straight-line depreciation to zero over a five-year life.
- Project life of five years.
- Incremental annual unit sales of 3,000 at a unit price of €600.
- Annual fixed cash expenses of €125,000; variable cash expenses of €125 per unit.
- The capital equipment is expected to be sold for €450,000 at the end of Year 5. At the end of the project, the net working capital investment will be recovered.
- Tax rate of 40 percent.
- Based on the capital asset pricing model, the required rate of return is 12 percent.

Hernández estimates the expected net present value (NPV) of the project to be €975,538 and the internal rate of return (IRR) to be 24.6 percent. She also performs a sensitivity analysis by changing the input variable assumptions used in her initial analysis.

When reviewing Hernández’s work, her supervisor, Arturo Costa, notes that she did not include changes in the depreciation method, initial fixed capital outlay, or inflation assumptions in her sensitivity analysis. As a result, Costa asks the following questions:

- Question 1 “What would be the effect on the project’s NPV if the initial fixed capital equipment outlay increased from €2,750,000 to €3,000,000, everything else held constant?”
- Question 2 “How would a higher than expected inflation rate affect the value of the real tax savings from depreciation and the value of the real after-tax interest expense, everything else held constant?”
- Question 3 “You are using a required rate of return of 12 percent when the company’s weighted average cost of capital (WACC) is 10 percent. Why are you using a required rate of return for the project greater than the company’s WACC?”

Before ending the meeting, Costa tells Hernández: “Last year the company produced a prototype at a cost of €500,000. Now management is having doubts about the market appeal of the product in its current design, and so they are considering delaying the start of the project for a year, until the prototype can be shown to industry experts.”

- 45 Using Hernández’s initial financial predictions, the estimated annual after-tax operating cash flow is *closest* to:
- A €780,000.
  - B €1,000,000.
  - C €1,075,000.
- 46 Using Hernández’s initial financial predictions, the estimated terminal year after-tax non-operating cash flow is *closest* to:
- A €195,000.
  - B €270,000.
  - C €345,000.
- 47 Hernández’s best response to Costa’s first question is that the project’s NPV would decrease by an amount *closest* to:
- A €142,000.
  - B €178,000.
  - C €250,000.
- 48 Hernández’s *best* response to Costa’s second question is that:
- A real tax savings from depreciation and real interest expense would be lower.
  - B real tax savings from depreciation would be higher and real interest expense would be lower.
  - C real tax savings from depreciation would be lower and real interest expense would be higher.
- 49 Hernández’s *best* response to Costa’s third question is: “Because:
- A the project will plot above the security market line.”
  - B the project’s beta is greater than the company’s beta.”
  - C the project’s IRR is greater than the required rate of return.”
- 50 Should Costa’s end-of-meeting comments result in changes to Hernández’s capital budgeting analysis?
- A No.
  - B Yes, but only to incorporate the possible delay.
  - C Yes, to incorporate both the possible delay and the cost of producing the prototype.
-

## SOLUTIONS

- 1** C is correct.

$$\text{Outlay} = \text{FCInv} + \text{NWCInv} - \text{Sal}_0 + T(\text{Sal}_0 - B_0)$$

$$\text{Outlay} = (350,000 + 110,000) + 73,000 - 0 + 0 = \$533,000$$

The installed cost is  $\$350,000 + \$110,000 = \$460,000$ , so the annual depreciation is  $\$460,000/5 = \$92,000$ . The annual after-tax operating cash flow for Years 1–5 is

$$\begin{aligned} \text{CF} &= (S - C - D)(1 - T) + D = (265,000 - 83,000 - 92,000)(1 - 0.40) + \\ &\quad 92,000 \end{aligned}$$

$$\text{CF} = \$146,000$$

The terminal year after-tax non-operating cash flow in Year 5 is

$$\begin{aligned} \text{TNOCF} &= \text{Sal}_5 + \text{NWCInv} - T(\text{Sal}_5 - B_5) = 85,000 + 73,000 - \\ &\quad 0.40(85,000 - 0) \end{aligned}$$

$$\text{TNOCF} = \$124,000$$

The NPV is

$$\text{NPV} = -533,000 + \sum_{t=1}^5 \frac{146,000}{1.10^t} + \frac{124,000}{1.10^5} = \$97,449$$

- 2** B is correct. The additional annual depreciation is  $\$100,000/8 = \$12,500$ . The depreciation tax savings is  $0.40 (\$12,500) = \$5,000$ . The change in project NPV is

$$-100,000 + \sum_{t=1}^8 \frac{5,000}{(1.10)^t} = -100,000 + 26,675 = -\$73,325$$

- 3** C is correct. Financing costs are not subtracted from the cash flows for either the NPV or the IRR. The effects of financing costs are captured in the discount rate used.
- 4** C is correct. The annual depreciation charge is  $\$400,000/10 = \$40,000$ . The after-tax operating cash flow in Year 1 should be

$$\begin{aligned} \text{CF} &= (S - C - D)(1 - T) + D \\ &= (240,000 - 110,000 - 40,000)(1 - 0.30) + 40,000 \\ &= 63,000 + 40,000 = \$103,000 \end{aligned}$$

- 5** C is correct. The terminal year after-tax non-operating cash flow is

$$\begin{aligned} \text{TNOCF} &= \text{Sal}_5 + \text{NWCInv} - T(\text{Sal}_5 - B_5) \\ &= 21 + 8 - 0.40(21 - 15) = £26.6 \text{ million} \end{aligned}$$

- 6** C is correct. The investment outlay is

$$\begin{aligned} \text{Outlay} &= \text{FCInv} + \text{NWCInv} - \text{Sal}_0 + T(\text{Sal}_0 - B_0) \\ &= (360,000 + 40,000) + 60,000 - 0 + 0 = \$460,000 \end{aligned}$$

- 7** A is correct. Depreciation will be  $\$400,000/5 = \$80,000$  per year. The annual after-tax operating cash flow is

$$\begin{aligned} \text{CF} &= (S - C - D)(1 - T) + D \\ &= [0 - (-140,000) - 80,000](1 - 0.40) + 80,000 = \$116,000 \end{aligned}$$

- 8** B is correct. The terminal year non-operating cash flow is

$$\begin{aligned} \text{TNOCF} &= \text{Sal}_5 + \text{NWCInv} - \text{T}(\text{Sal}_5 - \text{B}_5) \\ &= 120,000 + 60,000 - 0.40(120,000 - 0) = \$132,000 \end{aligned}$$

- 9** C is correct. The value of the depreciation tax savings is increased, and the value of the real after-tax interest expense is also increased. Due to the lower inflation, the value has increased (essentially discounting at a lower rate).
- 10** A is correct. The statement is correct for sensitivity analysis, but not for scenario analysis (in which several input variables are changed for each scenario).
- 11** B is correct. Either the least-common multiple of lives or the equivalent annual annuity approach should be used (both use the NPV, not the IRR). Concept 4 is correct as given.
- 12** C is correct. The problem gives EBIT not EBITDA.

$$\text{CF} = (\text{S} - \text{C} - \text{D})(1 - \text{T}) + \text{D} = 50(1 - 0.3) + 50 = €85 \text{ each year}$$

- 13** A is correct. Economic income is the cash flow plus the change in value, or economic income is the cash flow minus the economic depreciation (we will use the second expression):

$$V_0 = \frac{85}{1.12} + \frac{85}{1.12^2} = 143.65 \quad V_1 = \frac{85}{1.12} = 75.89 \quad V_2 = 0$$

$$\begin{aligned} \text{Economic income (Year 1)} &= \text{CF}_1 - (V_0 - V_1) \\ &= 85 - (143.65 - 75.89) \\ &= 85 - 67.76 = €17.24 \end{aligned}$$

$$\begin{aligned} \text{Economic income (Year 2)} &= \text{CF}_2 - (V_1 - V_2) \\ &= 85 - (75.89 - 0) \\ &= 85 - 75.89 = €9.11 \end{aligned}$$

- 14** C is correct.

$$\begin{aligned} \text{EP} &= \text{NOPAT} - \text{WACC} = \text{EBIT}(1 - \text{T}) - \text{WACC} \times \text{Capital} \\ \text{EP}(\text{Year 1}) &= 50(1 - 0.30) - 0.12(100) = 35 - 12 = €23 \\ \text{EP}(\text{Year 2}) &= 50(1 - 0.30) - 0.12(50) = 35 - 6 = €29 \\ \text{MVA} &= \frac{\text{EP}(\text{Year 1})}{1 + \text{WACC}} + \frac{\text{EP}(\text{Year 2})}{(1 + \text{WACC})^2} = \frac{23}{1.12} + \frac{29}{1.12^2} = €43.65 \end{aligned}$$

(An alternative way to get MVA is simply to find the NPV of the investment project.)

- 15** B is correct. The way to solve the problem is to calculate the equivalent annual annuity and choose the service life with the lowest annual cost. For a two-year service life, the NPV is

$$\text{NPV} = -40,000 + \frac{-12,000}{1.10^1} + \frac{-15,000}{1.10^2} + \frac{20,000}{1.10^2} = -46,776.86$$

The EAA ( $\text{PV} = -46,776.86$ ,  $N = 2$ , and  $i = 10\%$ ) is  $-26,952.38$ .

For a three-year service life, the NPV is

$$\begin{aligned} \text{NPV} &= -40,000 + \frac{-12,000}{1.10^1} + \frac{-15,000}{1.10^2} + \frac{-20,000}{1.10^3} + \frac{17,000}{1.10^3} \\ &= -65,559.73 \end{aligned}$$

The EAA ( $\text{PV} = -65,559.73$ ,  $N = 3$ , and  $i = 10\%$ ) is  $-26,362.54$ .

For a four-year service life, the NPV is

$$\begin{aligned} \text{NPV} &= -40,000 + \frac{-12,000}{1.10^1} + \frac{-15,000}{1.10^2} + \frac{-20,000}{1.10^3} + \frac{-25,000}{1.10^4} \\ &\quad + \frac{12,000}{1.10^4} = -87,211.26 \end{aligned}$$

The EAA ( $\text{PV} = -87,211.26$ ,  $N = 4$ , and  $i = 10\%$ ) is  $-27,512.61$ .

The three-year service life has the lowest annual cost. Laroche should replace the vans every three years.

- 16** A is correct. To help the selection process, use the profitability index for each project, which shows the total present value per dollar invested.

Project	Outlay	PV of Future Cash Flows	NPV	PI	PI Rank
1	31	44	13	1.419	1
2	15	21	6	1.400	2
3	12	16.5	4.5	1.375	(tie) 3
4	10	13	3	1.300	6
5	8	11	3	1.375	(tie) 3
6	6	8	2	1.333	5

Try to incorporate the high PI projects into the budget using trial and error. These trials include the following:

Set of Projects	Total Outlay	Total NPV
1 and 5	39	16
2, 3, and 4	37	13.5
2, 3, and 5	35	13.5
2, 4, 5, and 6	39	14

Among the sets of projects suggested, the optimal set is the one with the highest NPV, provided its total outlay does not exceed C\$40 million. The set consisting of Projects 1 and 5 produces the highest NPV.

- 17** B is correct.

If demand is "high," the NPV is

$$\text{NPV} = -190 + \sum_{t=1}^{10} \frac{40}{1.10^t} = \text{C\$}55.783 \text{ million}$$

If demand is "low," the NPV is

$$\text{NPV} = -190 + \sum_{t=1}^{10} \frac{20}{1.10^t} = -\text{C\$}67.109 \text{ million}$$

The expected NPV is  $0.50(55.783) + 0.50(-67.109) = -\text{C\$}5.663 \text{ million}$ .

- 18** B is correct. Assume we are at time = 1. The NPV of the expansion (at time 1) if demand is "high" is

$$\text{NPV} = -190 + \sum_{t=1}^9 \frac{40}{1.10^t} = \text{C\$}40.361 \text{ million}$$

The NPV of the expansion (at time 1) if demand is “low” is

$$\text{NPV} = -190 + \sum_{t=1}^9 \frac{20}{1.10^t} = -\text{C\$}74.820 \text{ million}$$

The optimal decision is to expand if demand is “high” and not expand if “low.” Because the expansion option is exercised only when its value is positive, which happens 50 percent of the time, the expected value of the expansion project, at time zero, is

$$\text{NPV} = \frac{1}{1.10} 0.50(40.361) = \text{C\$}18.346 \text{ million}$$

The total NPV of the initial project and the expansion project is

$$\text{NPV} = -\text{C\$}5.663 \text{ million} + \text{C\$}18.346 \text{ million} = \text{C\$}12.683 \text{ million}$$

The optional expansion project, handled optimally, adds sufficient value to make this a positive NPV project.

- 19 A is correct. Both suggestions are bad. In valuing projects, expected cash flows should be discounted at required rates of return that reflect their risk, not at a risk-free rate that ignores risk. Even though both options cannot be simultaneously exercised, they can both add value. If demand is high, you can exercise the growth option, and if demand is low, you can exercise the abandonment option.
- 20 B is correct. Both suggestions are good. Choosing projects with high IRRs might cause the company to concentrate on short-term projects that reduce the NPV of the company. Whenever the project risk differs from the company risk, a project-specific required rate of return should be used.
- 21 C is correct. The after-tax operating cash flow for each of the next three years is  $\$20,000 + \$40,000 = \$60,000$ . The book value in three years will be  $\$380,000$  (the original cost less three years' depreciation). So the terminal year after-tax non-operating cash flow will be  $\text{Sal}_3 - 0.30(\text{Sal}_3 - \$380,000)$ , where  $\text{Sal}_3$  is the selling price. For a 15 percent return, the PV of future cash flows must equal the investment:

$$500,000 = \frac{60,000}{1.15} + \frac{60,000}{1.15^2} + \frac{60,000}{1.15^3} + \frac{\text{Sal}_3 - 0.30(\text{Sal}_3 - 380,000)}{1.15^3}$$

There are several paths to follow to solve for  $\text{Sal}_3$ .

$$363,006.5 = \frac{\text{Sal}_3 - 0.30(\text{Sal}_3 - 380,000)}{1.15^3}$$

$$\text{Sal}_3 - 0.30(\text{Sal}_3 - 380,000) = 552,087.5$$

$$0.70 \text{ Sal}_3 = 438,087.5$$

$$\text{Sal}_3 = \$625,839$$

- 22 A is correct. The cash flows (in \$ million) for the 5-year gas project are as follows:

Time	Outlays	After-Tax Operating Cash Flows	Total After-Tax Cash Flows
0	6.0	0.0	-6.0
1	1.0	0.5	-0.5
2	0.0	4.0	4.0
3	0.0	4.0	4.0

Time	Outlays	After-Tax Operating Cash Flows	Total After-Tax Cash Flows
4	0.0	4.0	4.0
5	5.0	4.0	-1.0

Given the required rate of return of 18 percent, the NPV can be calculated with Equation 2 or with a financial calculator:

$$\text{NPV} = -6.0 + \frac{-0.5}{1.18} + \frac{4.0}{1.18^2} + \frac{4.0}{1.18^3} + \frac{4.0}{1.18^4} + \frac{-1.0}{1.18^5}$$

$$\text{NPV} = \$509,579$$

Similarly, the IRR can be calculated from Equation 3:

$$-6.0 + \frac{-0.5}{1+r} + \frac{4.0}{(1+r)^2} + \frac{4.0}{(1+r)^3} + \frac{4.0}{(1+r)^4} + \frac{-1.0}{(1+r)^5} = 0$$

Solving for  $r$  with a financial calculator or spreadsheet software will yield 21.4 percent for the internal rate of return. Note that in spite of the fact that we are dealing with a nonconventional cash flow pattern, the IRR has a unique solution. The NPV profile declines as the required rate of return increases, and the NPV value crosses the  $x$ -axis (required rate of return) only one time, at 21.4 percent.

- 23 C is correct. Because the mutually exclusive projects have unequal lives, the EAA should be used instead of the NPV. The NPV and EAA for the Pinto grinder are correct. For the Bolten grinder, the NPV is

$$\text{NPV} = -125,000 + \sum_{t=1}^4 \frac{47,000}{1.10^t} + \frac{20,000}{1.10^4} = 37,644$$

To find the Bolten EAA, take the NPV for Bolten and annualize it for four years ( $N = 4$ ,  $PV = 37,644$ , and  $i = 10\%$ ). The Bolten EAA is \$11,876. Consequently, the Pinto grinder has the better EAA of \$12,341.

- 24 B is correct. Goldberg's first comment is wrong. A project should be abandoned in the future only when its abandonment value is more than the discounted value of the remaining cash flows. Goldberg's second comment is correct.
- 25 A is correct. The \$10 million original cost is a sunk cost and not relevant. The correct investment is today's opportunity cost, the market value today. The correct discount rate is the project required rate of return.
- 26 C is correct. Even if they are the same size, a short-term project with a high IRR can have a lower NPV than a longer-term project. The immediate impact on EPS does not capture the full effect of the cash flows over the project's entire life.
- 27 A is correct. The annual depreciation charge for Years 1–6 is  $1.5/6 = 0.25$ . Annual after-tax operating cash flows for Years 1–6 are:

$$CF = (S - C - D)(1 - T) + D$$

$$CF = [0.10 - (-0.25) - 0.25](1 - 0.40) + 0.25$$

$$CF = 0.06 + 0.25 = €0.31 \text{ billion}$$

Annual after-tax operating cash flows for Years 7–12 are:

$$CF = (S - C - D)(1 - T) + D$$

$$CF = [0.10 - (-0.25) - 0](1 - 0.40) + 0$$

$$CF = €0.21 \text{ billion}$$

**28** B is correct.

Outlay at time zero is:

$$\text{Outlay} = \text{FCInv} + \text{NWCInv} - \text{Sal}_0 + T(\text{Sal}_0 - \text{B}_0)$$

$$\text{Outlay} = 1.50 + 0.40 - 0 + 0 = €1.90 \text{ billion}$$

Terminal year after-tax non-operating cash flow is

$$\text{TNOCF} = \text{Sal}_{12} + \text{NWCInv} - T(\text{Sal}_{12} - \text{B}_{12})$$

$$\text{TNOCF} = 0.50 + 0.40 - 0.40(0.50 - 0) = €0.70 \text{ billion}$$

**29** B is correct. The cash flows, computed in the first two questions, are as follows:

Time 0	-€1.90 billion
Time 1–6	€0.31 billion
Time 7–12	€0.21 billion
Time 12	€0.70 billion

The NPV is

$$\text{NPV} = -1.90 + \sum_{t=1}^6 \frac{0.31}{1.12^t} + \sum_{t=7}^{12} \frac{0.21}{1.12^t} + \frac{0.70}{1.12^{12}}$$

$$\begin{aligned}\text{NPV} &= -1.90 + 1.2745 + 0.4374 + 0.1797 \\ &= -€0.0084 \text{ billion} \approx -€0.01 \text{ billion}\end{aligned}$$

**30** A is correct. Accelerated depreciation shifts depreciation expense toward the earlier years so that first-year operating income after taxes will be lower. However, because depreciation is a noncash expense, it must be added back to operating income after taxes in order to obtain after-tax operating cash flow. This process shifts cash flows from later years to earlier years, increasing the NPV.

**31** C is correct. The outlay is lower by €0.24, which will decrease the annual depreciation by €0.04 for the first six years. The annual additional taxes from the loss of the depreciation tax shelter are  $€0.04(0.40) = €0.016$ . The after-tax cash flows are higher by €0.24 at time zero (because of the smaller investment) and lower by €0.016 for the first six years. The NPV increases by

$$\text{NPV} = +0.24 - \sum_{t=1}^6 \frac{0.016}{1.12^t} = 0.24 - 0.0658 = 0.1742 = €0.17 \text{ billion}$$

**32** A is correct. Both of the supervisor's comments are incorrect. Because the Bayonne Pharma project is a conventional project (an outflow followed by inflows), the multiple IRR problem cannot occur. The EAA is preferred over the NPV when dealing with mutually exclusive projects with differing lives, a scenario which is not relevant for this decision. The Bayonne Pharma project is free-standing, so the NPV approach is appropriate.

**33** B is correct.

$$\text{Economic income} = \text{Cash flow} - \text{Economic depreciation}$$

$$\text{Economic income (Year 1)} = \text{CF}_1 - (\text{V}_0 - \text{V}_1)$$

After-tax operating cash flow (CF) = (S – C – D)(1 – T) + D + After-tax salvage  
 salvage = EBIT(1 – T) + D + After-tax salvage

Year	1	2	3	4	5
EBIT	30,000	40,000	50,000	60,000	40,000
EBIT(1 – 0.40)	18,000	24,000	30,000	36,000	24,000
D	40,000	40,000	40,000	40,000	40,000
After-tax salvage					12,000
CF	58,000	64,000	70,000	76,000	76,000

$$CF_1 = 58,000$$

$$V_0 = \frac{58,000}{1.12} + \frac{64,000}{1.12^2} + \frac{70,000}{1.12^3} + \frac{76,000}{1.12^4} + \frac{76,000}{1.12^5} = 244,054.55$$

$$V_1 = \frac{64,000}{1.12} + \frac{70,000}{1.12^2} + \frac{76,000}{1.12^3} + \frac{76,000}{1.12^4} = 215,341.10$$

$$\text{Economic income (Year 1)} = 58,000 - (244,054.55 - 215,341.10)$$

$$\text{Economic income (Year 1)} = 58,000 - 28,713.45 = 29,286.55$$

**34** B is correct.

$$EP = NOPAT - \$WACC$$

$$NOPAT = EBIT(1 - \text{Tax rate}) = 30,000(1 - 0.40) = 18,000$$

$$\$WACC = WACC \times \text{Capital} = 0.12(200,000) = 24,000$$

$$EP = 18,000 - 24,000 = -6,000$$

**35** A is correct.

$$RI_t = NI_t - r_e B_{t-1}$$

$$RI_1 = 11,899 - 0.19(77,973) = 11,899 - 14,815 = -2,916$$

**36** C is correct. The value of equity is the PV of cash distributions to equity:

$$PV = \frac{37,542}{1.19} + \frac{39,536}{1.19^2} + \frac{41,201}{1.19^3} + \frac{42,496}{1.19^4} + \frac{40,375}{1.19^5} = 122,027$$

**37** B is correct. Robinson's first statement is wrong. The value of an asset is the present value of its future cash flows. Economic income each year is the cash flow minus economic depreciation, EI = CF – ED. For this company, which is declining in value each year, the economic depreciation is positive and EI is less than CF each year. Consequently, the present value of economic income (EI) will be less than the present value of future cash flows (CF). Robinson's second statement is correct.

**38** B is correct. Market value added is equal to the present value of EP. Its value, however, is not equal to the book value of equity. The calculation of MVA is shown below:

Year	1	2	3	4	5*
EBIT	30,000	40,000	50,000	60,000	60,000
NOPAT = EBIT(1 – 0.40)	18,000	24,000	30,000	36,000	36,000
Capital (beginning)	200,000	160,000	120,000	80,000	40,000

(continued)

Year	1	2	3	4	5*
\$WACC = 0.12 × Capital	24,000	19,200	14,400	9,600	4,800
EP = NOPAT – \$WACC	-6,000	4,800	15,600	26,400	31,200

\* The fifth year figures include the effects of salvage. Before-tax salvage of 20,000 (= 12,000/(1 – 0.40)) is added to EBIT. The after-tax salvage of 12,000 is included in NOPAT.

$$MVA = \frac{-6,000}{1.12} + \frac{4,800}{1.12^2} + \frac{15,600}{1.12^3} + \frac{26,400}{1.12^4} + \frac{31,200}{1.12^5} = 44,054.55$$

- 39 B is correct. The weighted average cost of capital for Embelesado is calculated as:

$$\begin{aligned} WACC &= (\text{Market weight of debt} \times \text{After-tax cost of debt}) + \\ &\quad (\text{Market weight of equity} \times \text{Cost of equity}) \end{aligned}$$

$$\begin{aligned} WACC &= w_d k_d (1 - T) + w_{cs} k_{cs} = 0.231(8.0\%)(1 - 0.35) + 0.769(13.0\%) \\ &= 1.201\% + 9.997\% \end{aligned}$$

$$WACC = 11.198\% = 11.20\%$$

- 40 C is correct. The terminal year cash flow is:

Revenues	€60.00
Less operating costs	25.00
Less depreciation expenses	20.00
= Taxable Income	15.00
Less taxes @ 35%	(5.25)
= Net Income	9.75
Plus depreciation expenses	20.00
= After-tax operating CF	29.75
+ Recover WC	10.00
+ Ending market value	5.00
Less taxes on sale proceeds @ 35%	(1.75)*
= Terminal Year CF	€43.00

\* The tax on the sale proceeds is 35% times the gain of €5.00 = €1.75

- 41 C is correct. This is the IRR for a project with the following cash flows: (€70,000) in Year 0, €29,750 at Years 1 and 2, and €43,000 at Year 3.

	Years 1 & 2	Year 3
Revenues	€60,000	€60,000
Less operating costs	25,000	25,000
Less depreciation expense	20,000	20,000
= Taxable income	15,000	15,000
Less taxes @ 35%	5,250	5,250
= Net income	9,750	9,750
Plus depreciation expense	20,000	20,000
= After-tax operating CF	€29,750	29,750
+ Recover WC		10,000
+ Salvage value		5,000

	Years 1 & 2	Year 3
- Less taxes on sal. value @ 35%		1,750
= Terminal year CF		€43,000

The IRR of 20.29% is readily found with a financial calculator:

$$70,000 = \frac{29,750}{(1 + IRR)^1} + \frac{29,750}{(1 + IRR)^2} + \frac{43,000}{(1 + IRR)^3}$$

You can also “reverse-engineer” the answer using the choices given in the question.

- 42** A is correct. Projects with shorter paybacks do not necessarily have a positive NPV. For mutually exclusive projects, the NPV and IRR criteria will not necessarily provide the same project ranking.
- 43** B is correct. Additional depreciation in earlier time periods will shield Embelesado from additional taxes, thus increasing the net cash flows in earlier years of the project and increasing the project’s NPV. However, this also means that there will be less depreciation expense in the terminal year of the project, thus shielding less income and increasing taxes. Terminal-year net cash flow will likely decrease.
- 44** A is correct. The entire €10 million will be subject to taxes, resulting in an additional €6.5 million after taxes. As indicated below, when discounted at 13 percent for three years, this has a present value of €4.5048 (rounded to €4.50 million):

$$PV = \frac{10.0(1 - 0.35)}{(1.13)^3} = \frac{6.50}{(1.13)^3} = 4.50$$

- 45** B is correct. Using equation  $CF = (S - C) \times (1 - T) + TD$ , the numbers are:

$$\begin{aligned} \text{Sales} &= P \times Q = €600 \times 3,000 = €1,800,000 \\ \text{Costs} &= \text{Variable cost} \times Q + \text{Fixed costs} = (125 \times 3,000) + \\ &\quad €125,000 \\ &= 500,000 \end{aligned}$$

$$\begin{aligned} \text{Depreciation expense} &= €2,750,000 \div 5 = €550,000 \\ CF &= (1,800,000 - 500,000) \times (1 - 0.40) + (550,000 \times \\ &\quad 0.40) \\ &= 780,000 + 220,000 = €1,000,000 \end{aligned}$$

- 46** C is correct. The terminal year non-operating cash flow includes the after-tax salvage value and the recovery of net working capital =  $€450,000 \times (1 - 0.40) + €75,000 = €345,000$ .

(Note: Terminal year recovery of net working capital investment  
 = Decrease in current assets – Decrease in current liabilities =  
 €200,000 – €125,000 = €75,000.)

- 47** B is correct. Calculations: The outlay is higher by €250,000, which will increase annual depreciation by €50,000 over the 5-year period. The annual additional tax savings from the higher depreciation expense is:  $50,000 \times (0.40) = 20,000$ . Therefore NPV should decrease by:

$$NPV = -250,000 + \sum_{t=1}^5 \frac{20,000}{1.12^t} = -250,000 + 72,095.524 = -177,904$$

- 48** A is correct. Higher than expected inflation increases the corporation's real taxes because it reduces the value of the depreciation tax shelter; it also decreases the real interest expense because payments to bondholders in real terms are lower than expected.
- 49** B is correct. When a project is more or less risky than the company, project beta and not WACC should be used to establish the required rate of return for the capital project. In this case, the required rate of return is greater than the WACC, which means the project beta (risk) is greater than the company's beta.
- 50** B is correct. Timing options (e.g., delay investing) should be included in the NPV analysis, but sunk costs should not.

## READING

# 20

## Capital Structure

by Raj Aggarwal, PhD, CFA, Pamela Peterson Drake, PhD, CFA,  
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### LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. explain the Modigliani–Miller propositions regarding capital structure, including the effects of leverage, taxes, financial distress, agency costs, and asymmetric information on a company's cost of equity, cost of capital, and optimal capital structure;
<input type="checkbox"/>	b. describe target capital structure and explain why a company's actual capital structure may fluctuate around its target;
<input type="checkbox"/>	c. describe the role of debt ratings in capital structure policy;
<input type="checkbox"/>	d. explain factors an analyst should consider in evaluating the effect of capital structure policy on valuation;
<input type="checkbox"/>	e. describe international differences in the use of financial leverage, factors that explain these differences, and implications of these differences for investment analysis.

### INTRODUCTION

1

The most important decision a company makes in its pursuit of maximizing its value is typically the decision concerning what products to manufacture and/or what services to offer. The decision on how to finance investments (e.g., in factories and equipment), the so-called capital structure decision, is often seen as less important, even secondary. As we will see in this reading, the importance of the capital structure decision depends on the assumptions one makes about capital markets and the agents operating in it.

Under the most restrictive set of assumptions, the capital structure decision—the choice between how much debt and how much equity a company uses in financing its investments—is irrelevant. That is, any level of debt is as good as any other, and the capital structure decision is not only secondary, it is irrelevant. However, as some of

the underlying assumptions are relaxed, the choice of how much debt to have in the capital structure becomes meaningful. Under a particular set of assumptions, it is even possible to have an optimal level of debt in the capital structure; that is, a level of debt at which company value is maximized.

The reading is organized as follows: In Section 2 we introduce the capital structure decision and discuss the assumptions and theories that lead to alternative capital structures. In Section 3 we present important practical issues for the analyst, such as the role of debt ratings in the capital structure decision and international differences in capital structure policies. The final section summarizes the reading.

## 2

## THE CAPITAL STRUCTURE DECISION

A company's **capital structure** is the mix of debt and equity the company uses to finance its business. The goal of a company's capital structure decision is to determine the financial leverage or capital structure that maximizes the value of the company by minimizing the weighted average cost of capital. The **weighted average cost of capital** (WACC) is given by the weighted average of the marginal costs of financing for each type of financing used. For a company with both debt and equity in its capital structure for which interest expense is tax deductible at a rate  $t$ , the WACC, which we will denote  $r_{wacc}$  is

$$r_{wacc} = \left( \frac{D}{V} \right) r_d (1 - t) + \left( \frac{E}{V} \right) r_e \quad (1)$$

where  $r_d$  is the before-tax marginal cost of debt,  $r_e$  is the marginal cost of equity, and  $t$  is the marginal tax rate.<sup>1</sup> Variables  $D$  and  $E$  denote the market value of the shareholders' outstanding debt and equity, respectively, and the value of the company is given by  $V = D + E$ . You will notice that the debt and equity costs of capital and the tax rate are all understood to be "marginal" rates. The overall cost of capital is therefore a marginal cost also: what it costs the company to raise additional capital using the specified mixture of debt and equity. Further, this is the current cost: what it would cost the company today. What it cost in the past is not relevant. Therefore, the cost of equity, the cost of debt, and the tax rate that we use throughout the remainder of this reading are marginal: the cost or tax rate for additional capital.

In the following section, we first consider the theoretical relationship between leverage and a company's value. We then examine the practical relationship between leverage and company value in equal depth.

### 2.1 Proposition I without Taxes: Capital Structure Irrelevance

In a now-classic paper, Nobel Prize-winning economists Franco Modigliani and Merton Miller argued the important theory that, given certain assumptions, a company's choice of capital structure does not affect its value.<sup>2</sup> The assumptions relate to expectations and markets:

- 1 Investors agree on the expected cash flows from a given investment. This means that all investors have the same expectations with respect to the cash flows from an investment in bonds or stocks. In other words, expectations are homogeneous.

<sup>1</sup> For simplicity, this discussion ignores preferred stock.

<sup>2</sup> Modigliani and Miller (1958).

- 2 Bonds and shares of stock are traded in **perfect capital markets**. This means that there are no transaction costs, no taxes, no bankruptcy costs, and everyone has the same information. In a perfect capital market, any two investments with identical cash flow streams and risk must trade for the same price.
- 3 Investors can borrow and lend at the risk-free rate.
- 4 There are no agency costs. This means that managers always act to maximize shareholder wealth.
- 5 The financing decision and the investment decision are independent of each other. This means that operating income is unaffected by changes in the capital structure.

Many of these assumptions are unrealistic, and we will examine the consequences of relaxing some of them later in this section. The important point is that Modigliani and Miller provided a basis for thinking about capital structure and the starting point for analysis. Consider the capital of a company to be a pie: Each slice represents how much of total capital is provided by a specific type of capital, e.g., by common equity. One can split it in any number of ways, but the size of the pie remains the same. Saying that the pie remains the same size is equivalent to saying that the present value of cash flows to the company remains the same. This can only happen if the future cash flow stream is expected to remain the same and the risk of that cash flow stream, as reflected by the cost of capital, remains the same. Modigliani and Miller prove that under these conditions, and given their assumptions, changing the capital structure (i.e., how the pie is sliced) does not affect value. In other words, in a perfect capital market with risk-free borrowing and lending and with investment and financing decisions independent of each other, investors can create the capital structure which they individually prefer for the company by borrowing and lending on their own accounts. The capital structure chosen by management does not matter because it can be adjusted to the desired capital structure by investors at no cost.

Suppose that a company has a capital structure consisting of 50 percent debt and 50 percent equity and that an investor would prefer that the company's capital structure be 70 percent debt and 30 percent equity. The investor uses borrowed money to finance his or her share purchases so that effectively ownership of company assets reflects the preferred 70 percent debt financing. To the extent this changing capital structure has no effect on the company's expected operating cash flows, the capital structure decision has no impact on company value. Modigliani and Miller use the concept of arbitrage to demonstrate their point: If the value of an unlevered company—that is, a company without any debt—is not equal to that of a levered company, investors could make an arbitrage profit. The arbitrage operation (selling the overvalued asset and using the proceeds to buy the undervalued asset) would quickly force the values to be equivalent.

The importance of the Modigliani and Miller theory is that it demonstrates that managers cannot create value simply by changing the company's capital structure. Consider why this might be true. The operating earnings of a business are available to the providers of its capital. In an all-equity company (that is, a company with no debt), all of the operating earnings are available to the equityholders and the value of the company is the present value of these operating earnings. If, on the other hand, a company is partially financed by debt, these operating earnings are split between the providers of capital: the equityholders and the debtholders. Under market equilibrium, the sum of the values of debt and equity in such a case should equal the value of the all-equity company. In other words, the value of a company is determined solely by its cash flows, not by the relative reliance on debt and equity capital.

This principle does not change the fact of the relative risks of leverage to debtholders versus equityholders. Adding leverage does increase the risk faced by the equityholders. In such a case, equityholders seek compensation for this extra risk by requiring a

higher return. Indeed, in equilibrium, the increase in equity returns is exactly offset by increases in the risk and the associated increase in the required rate of return on equity, so that there is no change in the value of the company.<sup>3</sup>

Modigliani and Miller (MM) first illustrated the capital structure irrelevance proposition under the condition of no taxes:

*MM Proposition I:*

The market value of a company is not affected by the capital structure of the company.

In other words, the value of the company levered ( $V_L$ ) is equal to the value unlevered ( $V_U$ ), or  $V_L = V_U$ . A crucial implication of MM Proposition I is that the weighted average cost of capital for a company in the no-tax case is unaffected by its capital structure.

To understand this proposition, we can think about two companies with the same expected, perpetual cash flows and uncertainty and, hence, the same discount rate applied to value these cash flows. Even if the companies have different capital structures, these two companies must have the same present value using discounted cash flow models. If capital structure changes were to have any effect on a company's value, there would exist an arbitrage opportunity to make riskless profits.

In a perfect market, investors can substitute their own leverage for a company's leverage by borrowing or lending appropriate amounts in addition to holding shares of the company. Because this process is costless for investors (we assume perfect markets), a company's financial leverage should have no impact on its value. Therefore, a company's capital structure is irrelevant in perfect markets (which assume no taxes).

## 2.2 Proposition II without Taxes: Higher Financial Leverage Raises the Cost of Equity

Modigliani and Miller's second proposition focuses on the cost of capital of the company:

*MM Proposition II:*

The cost of equity is a linear function of the company's debt/equity ratio.

Assuming that financial distress has no costs and that debtholders have prior claim to assets and income relative to equityholders, the cost of debt is less than the cost of equity. According to this proposition, as the company increases its use of debt financing, the cost of equity rises. We know from MM Proposition I that the value of the company is unchanged and the weighted average cost of capital remains constant if the company changes its capital structure. What Proposition II then means is that the cost of equity increases in such a manner as to exactly offset the increased use of cheaper debt in order to maintain a constant WACC.

The risk of the equity depends on two factors: the risk of the company's operations (business risk) and the degree of financial leverage (financial risk). Business risk determines the cost of capital, whereas the capital structure determines financial risk.

The weighted average cost of capital, or  $r_{wacc}$ , *ignoring taxes*, is

$$r_{wacc} = \left( \frac{D}{V} \right) r_d + \left( \frac{E}{V} \right) r_e \quad (2)$$

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<sup>3</sup> As a final point, in the absence of taxes, MM's capital structure irrelevance result holds whether debt is assumed to be risk-free (as MM assumed in their 1958 article) or risky, so long as there are no bankruptcy costs.

where

- $r_{wacc}$  = the weighted average cost of capital of the company
- $r_d$  = the before-tax marginal cost of debt capital, and is equal to the after-tax marginal cost of debt because there are no taxes by assumption
- $r_e$  = the marginal cost of equity capital
- $D$  = the market value of debt
- $E$  = the market value of equity
- $V$  = the value of the company, which is equal to  $D + E$

Let us define  $r_0$  as the cost of capital for a company financed only by equity (an "all-equity company"). Then, by MM Proposition I,  $r_{wacc} = r_0$ , so

$$r_{wacc} = \left(\frac{D}{V}\right)r_d + \left(\frac{E}{V}\right)r_e = r_0 \quad (3)$$

Recalling that  $D + E = V$  and using this to substitute for  $V$ , we can rearrange Equation 3 to solve for the cost of equity:

$$r_e = r_0 + (r_0 - r_d) \frac{D}{E} \quad (4)$$

Equation 4 is the precise expression for the cost of equity in MM Proposition II. As shown in Equation 4, the cost of equity is a linear function of the debt/equity ratio ( $D/E$ ) with the intercept equal to  $r_0$  and the slope coefficient equal to the positive quantity  $(r_0 - r_d)$ . We know that  $(r_0 - r_d)$  is positive because the cost of equity must be an increasing function of the debt/equity ratio for WACC to be unchanged as the use of debt in financing is increased, as required by Proposition I. Thus, as the debt/equity ratio increases, the cost of equity capital also increases. See Exhibit 1 later in this section.

Consider the example of the Leverkin Company, which currently has an all-equity capital structure. Leverkin has an expected operating income of \$5,000 and a cost of equity, which is also its WACC, of 10 percent. Adopting a common practice, we represent operating income by earnings before interest and taxes, EBIT. For simplicity, we will assume that the EBIT and other cash flows are perpetual. Let us suppose that Leverkin is planning to issue \$15,000 in debt at a cost of 5 percent in order to buy back \$15,000 worth of its equity.

Because there are no taxes and the EBIT is a perpetuity, we can compute the value of the all-equity Leverkin as the present value of its expected cash flows:

$$V = \frac{\text{EBIT}}{r_{wacc}} = \frac{\$5,000}{0.10} = \$50,000$$

Under MM Proposition I, because  $V_L = V_U$ , the value of Leverkin remains the same whether it is all-equity financed or has \$15,000 of debt. When it issues the debt, Leverkin pays an interest charge of 5% on this debt. That is, Leverkin's interest payment is  $0.05(\$15,000) = \$750$ .

By MM Proposition II, the cost of Leverkin's equity when it has \$15,000 debt and  $\$50,000 - \$15,000 = \$35,000$  equity is

$$r_e = 0.10 + (0.10 - 0.05) \frac{\$15,000}{\$35,000} \approx 0.12143 = 12.143\%$$

The value of Leverkin with \$15,000 debt in its capital structure must equal the sum of the present value of cash flows to debtholders and equityholders. With \$15,000 debt, Leverkin makes an interest payment of \$750 to debtholders, leaving \$5,000 – \$750 = \$4,250 for equityholders.

$$V = D + E = \frac{\$750}{0.05} + \frac{\$4,250}{0.12143} = \$15,000 + \$34,999.59 \approx \$50,000$$

It is straightforward to demonstrate that Leverkin's value remains at \$50,000 at any level of debt.<sup>4</sup> We can also confirm, using Equation 3, that Leverkin's WACC with the new capital structure remains at 10% as required by Proposition I:

$$r_{wacc} = \left( \frac{\$15,000}{\$50,000} \right) 0.05 + \left( \frac{\$35,000}{\$50,000} \right) 0.12143 = 0.10 = 10\%$$

Just as we can express the beta of any investment portfolio as a market-value weighted average of the betas of the investments in that portfolio, we can express the systematic risk of each of the sources of a company's capital in a similar manner.<sup>5</sup> In other words, we can represent the systematic risk of the assets of the entire company as a weighted average of the systematic risk of the company's debt and equity:

$$\beta_a = \left( \frac{D}{V} \right) \beta_d + \left( \frac{E}{V} \right) \beta_e \quad (5)$$

where  $\beta_a$  is the asset's systematic risk, or **asset beta**,  $\beta_d$  is the beta of debt, and  $\beta_e$  is the equity beta. The asset beta represents the amount of the assets' risk that is non-diversifiable (cannot be eliminated by holding those assets as part of a large, well-diversified portfolio).

According to Modigliani and Miller, the company's cost of capital does not depend on its capital structure but rather is determined by the business risk of the company. On the other hand, as the level of debt rises, the risk of the company defaulting on its debt increases. These costs are borne by the equityholders. So as the proportionate use of debt rises, the equity's beta,  $\beta_e$ , also rises. By reordering the formula of  $\beta_a$  to solve for  $\beta_e$ , we get

$$\beta_e = \beta_a + (\beta_a - \beta_d) \left( \frac{D}{E} \right) \quad (6)$$

In the next section, we look at the decision to use debt financing given the taxes and market imperfections found in the real world.

## 2.3 Taxes, the Cost of Capital, and the Value of the Company

Taxes are the first practical consideration in modifying the results of the MM propositions. In the discussion below we will present MM Propositions I and II with taxes.

Because interest paid is deductible from income for tax purposes in most countries, the use of debt provides a tax shield that translates into savings that enhance the value of a company. Indeed, ignoring other practical realities of costs of financial distress and bankruptcy, the value of the company increases with increasing levels of debt. In effect, by making the interest costs deductible for income taxes, the government subsidizes companies' use of debt. The actual cost of debt is reduced by the level of the company's tax benefit:

$$\text{After-tax cost of debt} = \text{Before-tax cost of debt} \times (1 - \text{Marginal tax rate})$$

<sup>4</sup> Note that this statement is true even with 100 percent debt financing because in that case, the debtholders are effectively the company's owners (equityholders).

<sup>5</sup> Hamada (1972).

Modigliani and Miller show that, in the presence of corporate taxes,<sup>6</sup> the value of the company with debt is greater than that of the all-equity company by an amount equal to the tax rate multiplied by the value of the debt. That is, MM Proposition I with corporate taxes is:

$$V_L = V_U + tD \quad (7)$$

where  $t$  is the marginal tax rate. The term  $tD$  is often referred to as the debt tax shield.

By introducing corporate tax, we adjust the weighted average cost of capital formula to reflect the impact of the tax benefit:

$$r_{wacc} = \left( \frac{D}{V} \right) r_d (1 - t) + \left( \frac{E}{V} \right) r_e \quad (8)$$

Because by Proposition I with taxes the value of a company with debt is greater than that of the same company without debt, *for the same level of operating income*, it must follow that the WACC for the company with debt *must be lower* than that for the all-equity company. If we continue to define  $r_0$  as the cost of capital for an all-equity company, MM show that the cost of equity for the same company with debt is:

$$r_e = r_0 + (r_0 - r_d)(1 - t) \frac{D}{E} \quad (9)$$

This is MM Proposition II when there are corporate taxes.<sup>7</sup> Notice that the difference between Equation 9 and MM Proposition II in the no-tax case (Equation 4) is the presence of the term  $(1 - t)$ . When  $t$  is not zero, the term  $(1 - t)$  is less than 1 and serves to lower the cost of leveraged equity when compared to the no-tax case.<sup>8</sup> That is, the cost of equity becomes greater as the company increases the amount of debt in its capital structure, but the cost of equity does not rise as fast as it does in the no-tax case. Equivalently, the slope coefficient is  $(r_0 - r_d)(1 - t)$ , which is smaller than the slope coefficient  $(r_0 - r_d)$  in the case of no taxes. As a consequence, the WACC for the levered company falls as debt increases, and overall company value increases. Therefore, if taxes are considered but financial distress and bankruptcy costs are not, debt financing is highly advantageous, and in the extreme, a company's optimal capital structure is all debt.

Let us return to the example of the Leverkin Company, which is currently all-equity, has an EBIT of \$5,000, and a WACC, which is also its cost of equity, of 10%. As before, Leverkin is planning to issue \$15,000 of debt in order to buy back an equivalent amount of equity. Now, however, Leverkin pays corporate taxes at a rate of 25%.

Because Leverkin must pay taxes, the after-tax cash flow available to its shareholders is earnings before taxes, EBT, times  $(1 - t)$ , or  $EBT(1 - t)$ .  $EBT(1 - t)$  is the same here as  $EBIT(1 - t)$  because  $I = 0$ . If we continue to assume perpetual cash flows, the value of the all-equity, or unlevered, Leverkin is:

$$V_U = \frac{EBT(1 - t)}{WACC} = \frac{\$5,000(1 - 0.25)}{0.10} = \$37,500$$

Note that the value of Leverkin when there are corporate taxes is less than its value in the no-tax case. This is simply because a new claimant on Leverkin's cash flows, the government through its ability to impose taxes, has entered the picture.

<sup>6</sup> We continue to assume that there are no personal taxes.

<sup>7</sup> The derivation of Equation 9 can be found in more advanced texts. See, for example, Copeland, Weston, and Shastri (2005).

<sup>8</sup> *Leveraged* and *levered* as used in discussion of capital structure are synonyms. Both terms are commonly used.

Let us now see what happens to Leverkin's value when it issues \$15,000 in debt and buys back stock. According to MM Proposition I, when there are corporate taxes, i.e., Equation 7,

$$V_L = V_U + tD = \$37,500 + 0.25(\$15,000) = \$41,250$$

Because the value of the debt is \$15,000, the value of the equity (after the buy-back) must be  $(\$41,250 - \$15,000) = \$26,250$ . According to MM Proposition II with corporate taxes (Equation 9), the cost of the levered equity is:

$$r_e = 0.10 + (0.10 - 0.05)(1 - 0.25) \frac{\$15,000}{\$26,250} = 0.12143 = 12.143\%$$

Because the value of the company must equal the present value of cash flows to debt and to equity,

$$\begin{aligned} V_L &= D + E = \frac{r_d D}{r_d} + \frac{(EBIT - r_d D)(1 - t)}{r_e} \\ &= \frac{\$750}{0.05} + \frac{(\$5,000 - \$750)(1 - 0.25)}{0.12143} \approx \$41,250 \end{aligned}$$

This is the value of the company as given by MM Proposition I. As a further check, using Equation 8, the WACC for the levered Leverkin is:

$$\begin{aligned} r_{wacc} &= \frac{\$15,000}{\$41,250}(0.05)(1 - 0.25) + \frac{\$26,250}{\$41,250}(0.12143) \\ &= 0.09091 = 9.091\% \end{aligned}$$

As expected, this is lower than the unlevered WACC of 10%. Because after taxes are paid, whatever is left of the cash flows can be claimed by debtholders and equityholders, we must also have:

$$V_L = \frac{EBIT(1 - t)}{WACC} = \frac{\$5,000(1 - 0.25)}{0.09091} \approx \$41,250$$

We can see the effect of taxes on the cost of capital in Exhibit 1. Here, we see that if there are no taxes, as shown in Panel B, the cost of capital is constant at  $r_{wacc} = r_0$ . If, on the other hand, interest is tax deductible, the cost of capital declines for ever-increasing use of debt financing, as shown in Panel C.

### Exhibit 1 Modigliani and Miller Propositions

#### Panel A. Value of the Company and Cost of Capital for Propositions without and with Taxes

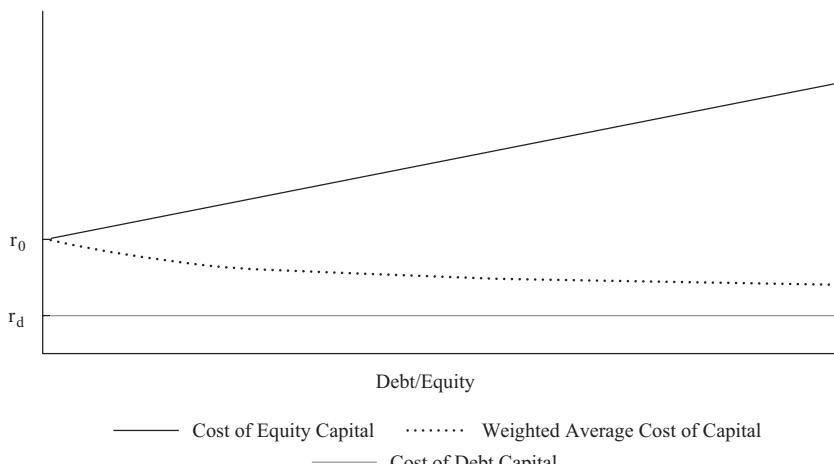
	Without Taxes	With Taxes
Proposition I	$V_L = V_U$	$V_L = V_U + tD$
Proposition II	$r_e = r_0 + (r_0 - r_d) \frac{D}{E}$	$r_e = r_0 + (r_0 - r_d)(1 - t) \frac{D}{E}$

**Exhibit 1 (Continued)****Panel B. Costs of Capital if There Are No Taxes**

Cost of Capital

**Panel C. Costs of Capital if There Are Taxes**

Cost of Capital

**EXAMPLE 1****The After-Tax Cost of Debt**

Payment People, a provider of temporary accounting workers, is considering an \$85 million acquisition. The company could raise capital by selling either debt or equity. If the company finances the acquisition with debt at 8 percent interest, what is the after-tax cost of issuing debt if the company's marginal tax rate is 34 percent?

**Solution:**

Annual interest expense on \$85 million at 8 percent is \$6.8 million. The \$6.8 million is deducted from income, saving  $\$6.8 \text{ million} \times 0.34 = \$2.312$  million in taxes. The after-tax interest cost is  $\$6.8 \text{ million} - \$2.312 \text{ million} = \$4.488$  million. The before-tax cost of debt is 8 percent; the after-tax cost of debt is

$$\text{After-tax cost of debt} = \$4.488 \text{ million}/\$85 \text{ million} = 5.28\%, \text{ or, equivalently, } 0.08(1 - 0.34) = 0.0528, \text{ or } 5.28\%$$

**EXAMPLE 2****The Cost of Equity**

Hotel chain Hostales Vacaciones finances land purchases for new hotels. Its current cost of capital, as an all-equity company, is 13 percent. The company is opening ten new hotels and is considering issuing debt at 9 percent for its financing needs. If it issues debt, its debt-to-equity ratio would be 0.5. The corporate tax rate is 32 percent. What would be the company's cost of equity with and without the consideration of taxes?

**Solution:**

*Without taxes*

$$r_e = r_0 + (r_0 - r_d) \left( \frac{D}{E} \right)$$

$$r_e = 0.13 + [(0.13 - 0.09)(0.5)] = 0.15, \text{ or } 15\%$$

*With taxes*

$$r_e = r_0 + (r_0 - r_d)(1 - t) \frac{D}{E}$$

$$r_e = 0.13 + [(0.13 - 0.09)(1 - 0.32)(0.5)] = 0.1436, \text{ or } 14.36\%$$

Thus, as expected, the cost of equity rises in both cases due to the addition of debt, but the increase is less when taxes are considered.

Miller (1977) introduced another aspect into the analysis of the tax benefits from the use of debt financing. He argued that if investors face different tax rates on dividend and interest income for their personal taxes, this situation may reduce the advantage of debt financing somewhat. If investors face a higher personal rate of tax on income from debt investments relative to stock investments, they will demand a higher return on debt—driving up the cost of debt to the company.<sup>9</sup> Thus, in the Miller model, whether or not financing with debt adds value to the company depends on the corporate tax rate, the personal tax rate on interest income, and the personal tax rate on dividend income. It is therefore possible in the Miller model, depending on the levels of the various tax rates, for debt to add value, lower value, or to have no effect on value.

<sup>9</sup> It can be argued that there is a higher personal tax on debt income because debt instruments typically provide investors with taxable interest periodically, whereas taxable income from stock investments could, conceivably, be lower because the tax consequences of investing in non-dividend-paying stocks are deferred until the stock is sold.

In practice, however, the value of a levered company is affected by more than the tax issues surrounding the use of debt. The analysis gets more complicated once we introduce factors such as the cost of financial distress, agency costs, and asymmetric information. We address these additional factors next.

## 2.4 Costs of Financial Distress

The downside of operating and financial leverage is that earnings are magnified downward during economic slowdowns. Lower or negative earnings put companies under stress, and this **financial distress** adds costs—both explicit and implicit—to a company. Even before taking the drastic step of filing for bankruptcy, companies under stress may lose customers, creditors, suppliers, and valuable employees to more secure competitors.

### EXAMPLE 3

#### Costs of Financial Distress

Enron is an extreme example of the loss of value due to financial distress. Up until its demise in 2001, Enron was a large player in the natural gas industry. Events leading up to the eventual bankruptcy protection filing caused investors to flee the common stock as creditors refused new lending. Enron went from a favored to a disdained company in record time.

According to a company presentation made ten days after its 2 December 2001 bankruptcy filing, the company's common stock price plunged from \$80 per share to \$1 per share prior to the bankruptcy announcement, losing \$25 billion in market value.<sup>10</sup> This loss in value was due to a number of factors, including:

- investors' and creditors' lost confidence;
- financial market reaction from a lack of access to capital markets;
- current maturities greatly exceeding operating cash flow because of the inability to refinance debt;
- nervous trade creditors;
- Dynegy pulling out of the merger on 28 November 2001; and
- the bond ratings downgrade on 28 November 2001.

Cash bankruptcy expenses listed in the bankruptcy filing documents totaled \$17.3 million, though the bankruptcy costs including accountants', advisors', and lawyers' fees were over \$500 million by November of 2003.<sup>11</sup>

The expected cost of financial distress is composed of two key ingredients: 1) the costs of financial distress and bankruptcy, in the event they happen, and 2) the probability that financial distress and bankruptcy happen. We can classify the costs of financial distress into direct and indirect costs. Direct costs of financial distress include the actual cash expenses associated with the bankruptcy process, such as legal and administrative fees. Indirect costs of financial distress include forgone investment opportunities, impaired ability to conduct business, and agency costs associated with the debt during periods in which the company is near or in bankruptcy.

<sup>10</sup> Enron Corporation Organizational Meeting, 12 December 2001.

<sup>11</sup> *Houston Business Journal*, 19 November 2003.

Companies whose assets have a ready secondary market have lower costs associated with financial distress. Companies with relatively marketable tangible assets, such as airlines, shipping companies, and steel manufacturers, incur lower costs from financial distress because such assets are usually more readily marketable. On the other hand, companies with few tangible assets, such as high-tech growth companies, pharmaceutical companies, information technology companies, and others in the service industry, have less to liquidate and therefore have a higher cost associated with financial distress.

The probability of bankruptcy increases as the degree of leverage increases. The probability of bankruptcy for a given company depends on how the fixed costs of debt service interact with the instability of the business environment and the reserves available to the company to delay bankruptcy. In other words, the probability of bankruptcy depends, in part, on the company's business risk. Other factors that affect the likelihood of bankruptcy include the company's corporate governance structure and the management of the company.

## 2.5 Agency Costs

**Agency costs** are the costs associated with the fact that all public companies and the larger private companies are managed by non-owners. Agency costs are the incremental costs arising from conflicts of interest when an agent makes decisions for a principal. In the context of a corporation, agency costs arise from conflicts of interest between managers, shareholders, and bondholders. In the following, “perquisite consumption” refers to items that executives may legally authorize for themselves that have a cost to shareholders, such as subsidized dining, a corporate jet fleet, chauffeured limousines, and so forth.

The smaller the stake that managers have in the company, the less is their share in bearing the cost of excessive perquisite consumption or not giving their best efforts in running the company. The costs arising from this conflict of interest have been called the **agency costs of equity**. Given that outside shareholders are aware of this conflict, they will take actions to minimize the loss, such as requiring audited financial statements. The net agency costs of equity therefore have three components:<sup>12</sup>

- 1 **Monitoring costs.** These are the costs borne by owners to monitor the management of the company and include the expenses of the annual report, board of director expenses, and the cost of the annual meeting.
- 2 **Bonding costs.** These are the costs borne by management to assure owners that they are working in the owners' best interest. These include the implicit cost of noncompete employment contracts and the explicit cost of insurance to guarantee performance.
- 3 **Residual loss.** This consists of the costs that are incurred even when there is sufficient monitoring and bonding, because monitoring and bonding mechanisms are not perfect.

The better a company is governed, the lower the agency costs. Good governance practices translate into higher shareholder value, reflecting the fact that managers' interests are better aligned with those of shareholders. Additionally, agency theory predicts that a reduction in net agency costs of equity results from an increase in the use of debt versus equity. That is, there are equity-agency cost savings associated with the use of debt. Similarly, the more financially leveraged a company is, the less freedom managers have to either take on more debt or unwisely spend cash. This is

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<sup>12</sup> Jensen and Meckling (1976) provide this breakdown of agency costs.

the foundation of Michael Jensen's **free cash flow hypothesis**.<sup>13</sup> According to Jensen's hypothesis, higher debt levels discipline managers by forcing them to manage the company efficiently so the company can make its interest and principal payments and by reducing the company's free cash flow and thus management's opportunities to misuse cash.<sup>14</sup>

## 2.6 Costs of Asymmetric Information

**Asymmetric information** (an unequal distribution of information) arises from the fact that managers have more information about a company's performance and prospects (including future investment opportunities) than do outsiders such as owners and creditors. Whereas all companies have a certain level of asymmetric information, companies with comparatively high asymmetry in information are those with complex products like high-tech companies, companies with little transparency in financial accounting information, or companies with lower levels of institutional ownership. Providers of both debt and equity capital demand higher returns from companies with higher asymmetry in information because they have a greater likelihood of agency costs.

Some degree of asymmetric information always exists because investors never know as much as managers and other insiders. Consequently, investors often closely watch manager behavior for insight into insider opinions on the company's future prospects. Being aware of this scrutiny, managers take into account how their actions might be interpreted by outsiders. The signaling model of capital structure suggests there may be a hierarchy ("pecking order") to the selection of methods for financing new investments.

The **pecking order theory**, developed by Myers and Majluf (1984), suggests that managers choose methods of financing according to a hierarchy that gives first preference to methods with the least potential information content (internally generated funds) and lowest preference to the form with the greatest potential information content (public equity offerings).<sup>15</sup> In brief, managers prefer internal financing; and if internal financing is insufficient, managers next prefer debt, and finally equity. Another implication of the work of Myers and Majluf is that financial managers tend to issue equity when they believe the stock is overvalued but are reluctant to issue equity if they believe the stock is undervalued. Thus, additional issuance of stock is often interpreted by investors as a negative signal.

We can read the signals that managers provide in their choice of financing method. For example, commitments to fixed payments, such as dividends and debt service payments, may be interpreted as the company's management having confidence in the company's future prospects of making payments. Such signals are considered too costly for poorly performing companies to afford. Alternatively, the signal of raising money at the top of the pecking order and issuing equity at the bottom of the pecking order holds other clues. If, for instance, the company's cost of capital increases after an equity issuance, we may interpret this effect as an indication that management needed capital beyond what comes cheaply; in other words, this is a negative signal regarding the company's future prospects.

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<sup>13</sup> Jensen (1986).

<sup>14</sup> Harvey, Lins, and Roper (2004) observe that this discipline is especially important in emerging markets, in which there is a tendency to overinvest.

<sup>15</sup> In general, public equity offerings are very closely scrutinized because investors are typically skeptical that existing owners would share ownership of a company with a great future with other investors.

## 2.7 The Optimal Capital Structure According to the Static Trade-Off Theory

When companies make decisions about financial leverage, they must weigh the value-enhancing effects of leverage from the tax deductibility of interest against the value-reducing impact of the costs of financial distress or bankruptcy, agency costs of debt, and asymmetric information. Putting together all the pieces of the theory of Modigliani and Miller, along with the taxes, costs of financial distress, debt agency costs, and asymmetric information, we see that as financial leverage is increased, there comes a point beyond which further increases in value from value-enhancing effects are offset completely by value-reducing effects. This point is known as the **optimal capital structure**. In other words, the optimal capital structure is that capital structure at which the value of the company is maximized.

Considering only the tax shield provided by debt and the costs of financial distress, the expression for the value of a leveraged company becomes

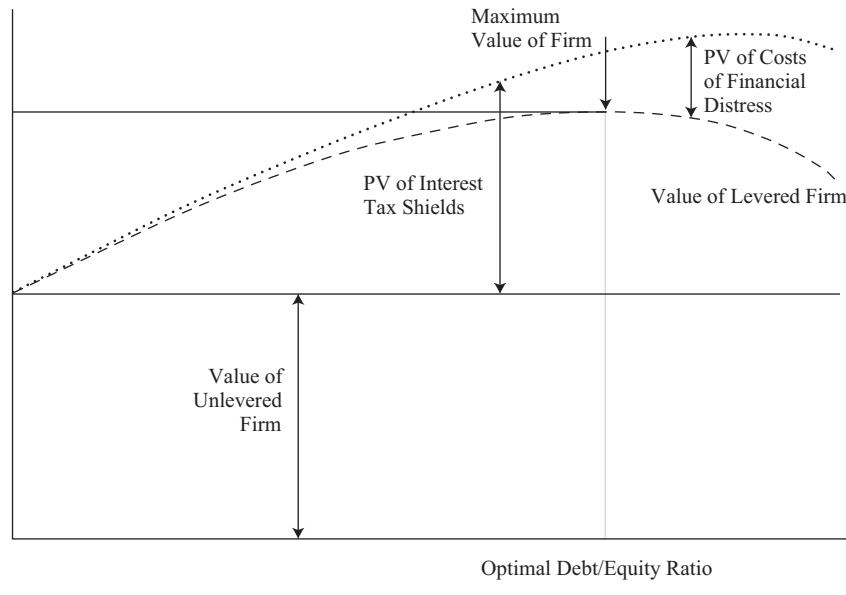
$$V_L = V_U + tD - PV(\text{Costs of financial distress}) \quad (10)$$

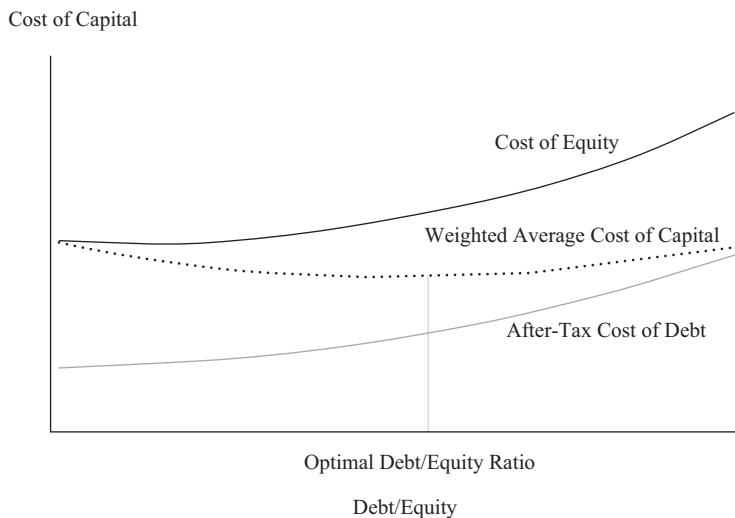
Equation 10 represents the **static trade-off theory of capital structure**. It results in an optimal capital structure such that debt constitutes less than 100 percent of a company's capital structure. We diagram this optimum in Exhibit 2.

### Exhibit 2 Trade-off Theory with Taxes and Cost of Financial Distress

#### Panel A. Value of the Company and the Debt/Equity Ratio

Market Value of the Firm



**Exhibit 2 (Continued)****Panel B. Cost of Capital and the Debt/Equity Ratio**

The static trade-off theory of capital structure is based on balancing the expected costs from financial distress against the tax benefits of debt service payments, as shown in Panel A of Exhibit 2. Unlike the Modigliani and Miller proposition of no optimal capital structure, or a structure with almost all debt when the tax shield is considered, static trade-off theory puts forth an optimal capital structure with an optimal proportion of debt. Optimal debt usage is found at the point where any additional debt would cause the costs of financial distress to increase by a greater amount than the benefit of the additional tax shield.

We cannot say precisely at which level of debt financing a company reaches its optimal capital structure. The optimal capital structure depends on the company's business risk, combined with its tax situation, corporate governance, and financial accounting information transparency, among other factors. However, what we can say, based on this theory, is that a company should consider a number of factors, including its business risk and the possible costs of financial distress, in determining its capital structure.

A company's management uses these tools to decide the level of debt appropriate for the company. The tax benefit from the deductibility of the interest expense on debt must be balanced against the risk associated with the use of debt. The extent of financial leverage used should thus depend on owners' and management's appetites for risk, as well as the stability of the company's business environment. Indeed, as we show in Panel B of Exhibit 2, as the proportion of debt in a business rises, the costs of both debt and equity are likely to rise to offset the higher risks associated with higher levels of debt. These cost increases reduce or even negate the cost savings due to the greater use of debt, the cheaper source of financing. The result is a U-shaped weighted average cost of capital curve.

When the company recognizes its most appropriate or best capital structure, it may adopt this as its **target capital structure**. Because management may exploit short-term opportunities in one or another financing source and because market-value fluctuations continuously affect the company's capital structure, a company's capital structure at any point in time may differ from the target. In addition, it may be impractical (due to market conditions making it inadvisable to raise capital) and

expensive (because of flotation costs) for a company to continuously maintain its target structure. Nevertheless, so long as the assumptions of the analysis and the target are unchanged, analysts and management should focus on the target capital structure.

#### EXAMPLE 4

### Financial Leverage and the Cost of Capital

The (hypothetical) Singapore-based Chuang Ho Company provides copper-wired components for cellular telephone manufacturers globally. Chuang Ho is going to establish a subsidiary that would require assets of SGD 3 billion, and wants to select a capital structure that would minimize its cost of capital for the subsidiary. Alex Ahn, the company's CFO, wants to evaluate a target leverage structure and uses a scenario approach to evaluate the cost of capital for the present 0 percent debt and possible 50 percent debt or 80 percent debt. Chuang Ho's marginal tax rate is 35 percent. Ahn has gathered the following information regarding costs of capital:

- The marginal cost of equity rises with increased levels of debt from 13.5 percent (no debt) to 18 percent (50 percent debt), to 28 percent (80 percent debt).
- The marginal cost of borrowing is 12 percent on 50 percent debt, and 18 percent on 80 percent debt.

Which capital structure is expected to have the lowest cost of capital?

#### Solution:

First, calculate the cost of capital under the three scenarios:

**Exhibit 3 Chuang Ho Subsidiary**

	<b>Leverage</b>		
	<b>No Debt</b>	<b>50% Debt</b>	<b>80% Debt</b>
Assets	\$3,000,000,000	\$3,000,000,000	\$3,000,000,000
Debt	\$0	\$1,500,000,000	\$2,400,000,000
Equity	\$3,000,000,000	\$1,500,000,000	\$600,000,000
Debt/Equity ratio	0	1	4
Proportion of debt	0%	50%	80%
Proportion of equity	100%	50%	20%
Before-tax cost of debt	—	12%	18%
Cost of equity	13.5%	18%	28%
After-tax cost of debt = $r_d(1 - t)$	—	7.8%	11.7%
Weighted average cost of capital	13.5%	12.9%	14.96%

Of the three capital structures that we are evaluating, the cost of capital is lowest for 50 percent debt.

## PRACTICAL ISSUES IN CAPITAL STRUCTURE POLICY

3

Although capital structure theories should serve to inform an analyst's decision-making process in valuing a company, there are several practical aspects of capital structure to consider. These include the evaluation of company credit-worthiness by independent agencies, an understanding of the industry to which the company belongs, and an analysis of the legal, institutional, and macroeconomic environment in which the company operates. We consider these factors next.

### 3.1 Debt Ratings

**Debt ratings** are an important consideration in the practical management of leverage. As leverage rises, rating agencies tend to lower the ratings of the company's debt to reflect the higher credit risk resulting from the increasing leverage. Lower ratings signify higher risk to both equity and debt capital providers, who therefore demand higher returns.

Most large companies pay one or more rating services to rate their bonds. Debt issues are rated for credit-worthiness by credit rating agencies. Among credit rating agencies with status as "Nationally Recognized Statistical Rating Organizations" from the US Securities and Exchange Commission (SEC), the three largest are Moody's, Standard & Poor's, and Fitch. Rating agencies perform a financial analysis of the company's ability to pay the promised cash flows, as well as an analysis of the bond's indenture, the set of complex legal documents associated with the issuance of debt instruments.

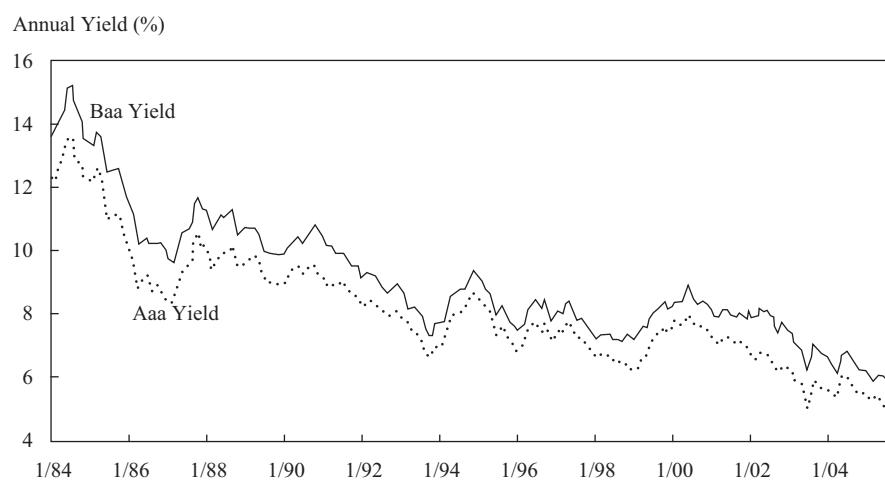
**Exhibit 4 Bond Ratings by Moody's, Standard & Poor's, and Fitch**

	Moody's	Standard & Poor's	Fitch	
Highest quality	Aaa	AAA	AAA	Investment grade
High quality	Aa	AA	AA	
Upper medium grade	A	A	A	
Medium grade	Baa	BBB	BBB	
Speculative	Ba	BB	BB	Speculative grade
Highly speculative	B	B	B	
Substantial risk	Caa	CCC	CCC	
Extremely speculative	Ca			
Possibly in default	C			
Default		D	DDD-D	

These agencies evaluate a wealth of information about the issuer and the bond, including the bond's characteristics and indenture, and provide investors with an assessment of the company's ability to pay the interest and principal on the bond as promised. We provide the bond rating classifications in Exhibit 4. Although there is significant agreement in ratings among the three major services, some disagreements do occur. For example, Standard & Poor's lowered the credit rating of General Motors to speculative grade in early May of 2005, but Moody's did not do so until late August of 2005.

In practice, most managers consider the company's debt rating in their policies regarding capital structure. Managers must be mindful of their company's bond ratings because the cost of capital is tied closely to bond ratings. Consider the difference in the yields on Aaa and Baa rated corporate bonds, as shown in Exhibit 5. Typically, a difference of 100 basis points exists between the yields of Aaa and Baa bonds, though this spread widens in economic recessions.<sup>16</sup> The cost of debt increases significantly when a bond's rating drops from investment grade to speculative grade. For example, when the rating of General Motors' unsecured 7.2 percent bond maturing in 2011 was changed by Moody's from Baa to Ba, the bond's price fell by over 7.5 percent and its yield rose from 7.541 percent to 9.364 percent.

**Exhibit 5 Yields on Aaa and Baa Rated Corporate Bonds, 1984–2005**



Source: Board of Governors of the Federal Reserve System, release H.15.

### 3.2 Evaluating Capital Structure Policy

In evaluating a company's capital structure, the financial analyst must look at the capital structure of the company over time, the capital structure of competitors that have similar business risk, and company-specific factors, such as the quality of corporate governance, that may affect agency costs, among other factors.<sup>17</sup> The financial analyst is not privy to the company's target capital structure but rather can evaluate the company's ability to handle its financial obligations and the potential role of costs of financial distress in determining how much financial leverage a company can handle.

Several practical considerations are important in this regard, such as the industry in which a company operates, the volatility of the company's cash flows, and its need for financial flexibility. Regulatory aspects can also play a role. For example, companies in the utility industry have relatively stable cash flows because they have a natural monopoly. Such companies usually also have a low degree of information asymmetry. As a result, utility companies tend to have much more debt than companies in

<sup>16</sup> The Board of Governors of the Federal Reserve System H.15 series of Aaa and Baa corporate yields shows an average spread of 119 basis points between Aaa and Baa rated bonds, on average, from 1919 to mid-2005. The largest spread occurred in 1932, with 565 bps, and the lowest spread occurred in 1966, with a 32 bp difference.

<sup>17</sup> Good corporate governance should lower the net agency costs of equity.

other industries. Similarly, the guarantee afforded by deposit insurance in the United States, for example, allows banks in the United States to have debt levels in excess of 80 percent of assets. In contrast, companies in the technology or pharmaceutical industries tend to have little or no debt for the following reasons: 1) they have few tangible assets (their assets are chiefly human capital, patents, ideas, etc.), 2) there is a high degree of information asymmetry (such companies spend a lot on research and development and are very secretive about their products), and 3) they have a great need for financial flexibility (they need to respond quickly to competitive and other changes in their operating environment).

A common goal of capital structure decisions is to finance at the lowest cost of capital. Analysts can use a scenario approach to assess this point for a particular company, starting with the current cost of capital for a company and considering various changes to answer the following questions:

- 1 What happens to the cost of capital as the debt ratio is changed?
- 2 At what debt ratio is the cost of capital minimized and company value maximized?
- 3 To what extent are stock price and company value affected when market conditions make it difficult or impossible for a company to maintain its optimal capital structure?

### **3.3 Leverage in an International Setting**

Modigliani and Miller told us that under several conditions the market value of a company is independent of its capital structure. However, we know that a company's capital structure is indeed relevant in the real world because of the effects of taxation, the costs of financial distress, and agency costs. The static trade-off theory suggests that the optimal level of leverage should be the level at which the value of the company is maximized; this is the level of debt financing at which any additional debt increases the costs of financial distress by an amount greater than the benefit from interest deductibility.

A company's capital structure largely depends on company-specific factors such as the probability of bankruptcy, profitability, quality and structure of assets, and growth opportunities. Beyond these factors, the company's industry affiliation, as well as the characteristics of the country where the company operates, can also account for differences in capital structure.

The general business environment differs from one country to another, and researchers show that country-specific factors have explanatory power similar to or even greater than that of the company's industry affiliation in determining a company's capital structure.<sup>18</sup> Comparing financial leverage indicators of a US-based energy company and a Japanese energy company is not meaningful if we do not take country-specific differences into account. Tradition, tax policy, and regulation may largely explain the different degrees of leverage in the two countries.

In examining the capital structure and debt maturity structure of corporations in an international context, researchers generally find that differences in the capital structures exist between developed and emerging markets, as well as across the developed countries. Moreover, the debt maturity structure—another important capital structure decision—also tends to vary across the international setting. Therefore, when analysts focus on the capital structure of companies in an international setting,

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<sup>18</sup> See, for example, Fan, Titman, and Twite (2012).

they must consider both the relative use of debt and the maturity structure of debt. In fact, short-term and long-term debt ratios follow very different patterns in an international comparison:

- Taking total debt into account, companies in France, Italy, and Japan tend to be more highly levered than companies in the United States and the United Kingdom.
- Focusing on the use of long-term debt, on the other hand, a different picture emerges: North American companies tend to use more long-term debt than do Japanese companies.
- Companies in developed markets typically use more long-term debt and tend to have higher long-term debt to total debt ratios compared to their emerging market peers.

Beyond the pure comparison of the capital structures, it is equally or even more important to identify and understand the country-specific factors that explain the cross-country differences.<sup>19</sup> Three major types of factors may be used to explain most capital structure differences in an international comparison:

- 1 *Institutional and legal environment*: These factors represent the legal and regulatory environment in which companies operate, as well as the requirements related to financial reporting. These institutional factors—including taxation, accounting standards, and even the presence or lack of corruption—may affect a company's optimal capital structure.
- 2 *Financial markets and banking sector*: These factors include characteristics of the banking sector, as well as the size and activity of the financial markets. Financial institutions are crucial for companies' access to financing.
- 3 *Macroeconomic environment*: These factors capture the general economic and business environment, addressing the influence of economic growth and inflation on the capital structure.

### 3.3.1 Institutional and Legal Environment

Taxation, financial legislation, the content of laws (e.g., bankruptcy law), and the quality of enforcement all differ from one country to another. These differences may influence the capital structures of companies and explain many of the differences that we observe across countries.

The apparent conflict of interest between a company's management and outside investors has already been addressed as the agency problem. This problem is, in fact, one of the key determinants of a company's ability to obtain capital; hence, agency costs are one of the major factors determining the capital structure. This conflict may be mitigated by carefully prepared contracts. The quality of investors' legal protections depends on both the content and the enforcement of the contracts and laws. As a result, we expect to see higher financial leverage in those countries that have weaker legal systems. Further, in countries with weaker legal systems, we expect a greater use of short-term debt financing versus long-term debt financing. Researchers find that companies operating in countries with an efficient legal system tend to use more long-term debt than short-term debt and exhibit lower leverage than comparable companies in countries with weaker legal systems.

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<sup>19</sup> We should note that conclusions drawn in different studies are not always consistent with each other. The results of empirical studies, in fact, may depend on several factors, such as the set of countries and companies taken into the data sample, the analyzed historical period, the hypotheses that the researchers intended to test, and even the definition of leverage that they considered.

Some researchers assume that legal systems based on common law offer external capital providers (both equity and debt providers) better protection compared to the legal systems of civil-law countries. Common law originated in England and is also followed in other countries, such as the United States, Canada, Australia, New Zealand, Singapore, India, and Malaysia. Civil law, on the other hand, has origins going back to ancient Rome; the countries of continental Europe and most of the rest of the world have legal systems based on this tradition. Researchers find mixed and limited evidence that companies operating in common-law countries tend to have longer debt maturity structures compared to their peers in civil-law countries, and use less debt and more equity in their capital structure.

Similar to the rationale described in the case of legal system efficiency, a high level of information asymmetry between insiders and outsiders encourages a greater use of debt relative to equity, as well as a greater reliance on short-term debt than on long-term debt in the capital structure. This is likely due to the fact that enforcing the debt contract is easier than enforcing the less clearly contracted shareholders' rights. Auditors and financial analysts can help reduce information asymmetries and increase the level of transparency.<sup>20</sup> Researchers confirm that the presence of auditors and analysts is associated with lower financial leverage. The importance of auditors is usually strongest in emerging markets, whereas the presence of analysts is more important in developed markets.

As we discussed earlier, taxes affect the capital structure decision by lowering the cost of debt financing to the issuer in those jurisdictions in which interest expense is tax deductible. In the absence of debt agency costs and bankruptcy costs, the benefit from the tax deductibility of interest encourages companies to use debt financing instead of equity financing. However, if dividend income is taxed at lower rates than interest income, some of the advantage of debt versus equity financing may be reduced from the corporate perspective because the price at which equity can be sold should reflect that advantage. Taxes are an important factor in a company's capital structure decision.

Researchers find mixed results on the effect of the corporate tax rate on capital structures, but they find that personal tax rates do matter. Because the tax treatment of dividends differs across countries, researchers can examine the importance of different tax treatments of dividend income.<sup>21</sup> They find that companies in countries that have lower tax rates on dividend income also have less debt in their capital structures.

### **3.3.2 Financial Markets and the Banking Sector**

The size, activity, and liquidity of capital markets are crucial for corporations' access to capital. Several researchers have analyzed the impact of capital markets' characteristics on companies' capital structures. Some find that liquid and active capital markets affect companies' debt maturity structure. Specifically, they find that companies in countries that have liquid and active capital markets tend to use more long-term (as opposed to short-term) debt with longer maturity (30-year maturity is preferred to 15-year maturity). Researchers attribute this finding to the heightened external monitoring of companies by market participants in active markets.<sup>22</sup>

The banking sector is one of the primary sources of funds for the corporate sector in many countries, and its role is especially significant in countries that do not have a corporate bond market. The importance of the banking sector relative to the capital markets can vary from one country to another, however. Countries with a common-law tradition, where the shareholders' rights are stronger, tend to be more market-based, whereas civil-law countries tend to be more bank-based. Because the relationship

<sup>20</sup> Fan et al. (2003).

<sup>21</sup> Fan et al. (2003).

<sup>22</sup> See Demirguc-Kunt and Maksimovic (1998).

between a bank and a company is stronger and closer than between a company and a bondholder, banks can handle information asymmetries more efficiently. This effect may partly explain why civil-law countries are more bank-oriented.

However, researchers' findings are mixed regarding the effect of the banking system. Some researchers claim that banks have no effect on companies' financial leverage and that the difference between the bank-oriented and market-oriented countries is more reflected by the relative importance of public financing (i.e., stock and bonds) and private financing (i.e., bank loans).<sup>23</sup> On the other hand, some researchers find that companies in bank-based countries exhibit higher financial leverage compared to those that operate in market-based countries.<sup>24</sup>

The presence of institutional investors may also affect the companies' capital structure choice. Some institutional investors may have preferred debt maturities ("preferred habitats"), and this preference may affect companies' debt maturity structure. Insurance companies and pension plans, for example, may prefer investing in long-term debt securities in order to match the interest rate risk of their long-term liabilities. Researchers find limited results regarding the influence of preferred habitats; companies in countries that have more institutional investors in their markets tend to have more long-term debt and somewhat lower debt-to-equity ratios.<sup>25</sup>

### 3.3.3 Macroeconomic Environment

Inflation is a widely recognized macroeconomic indicator. High inflation has a negative impact on both the level of debt financing and the use of long-maturity debt.<sup>26</sup> Companies in higher-inflation countries usually exhibit lower levels of financial leverage, rely more on equity financing, and have a shorter debt maturity structure compared to their peers in lower-inflation countries.

Researchers have also found that the growth in gross domestic product is associated with longer debt maturity in developed markets. In addition, researchers focusing on developing countries find that companies in countries with high growth rely more on equity financing.<sup>27</sup>

### 3.3.4 Conclusions

Financial analysts must consider country-specific factors when analyzing and comparing companies that operate in different countries. We have summarized these factors in Exhibit 6.

#### Exhibit 6 Country-Specific Factors and Their Assumed Impacts on the Companies' Capital Structure

Country-Specific Factor	If a Country	... Then D/E Ratio Is Potentially	... And Debt Maturity Is Potentially
<i>Institutional framework</i>			
Legal system efficiency	Is more efficient	Lower	Longer
Legal system origin	Has common law as opposed to civil law	Lower	Longer
Information intermediaries	Has auditors and analysts	Lower	Longer
Taxation	Has taxes that favor equity	Lower	

<sup>23</sup> Rajan (1995).

<sup>24</sup> See, for example, Claessens, Djankov, and Nevova (2001).

<sup>25</sup> See Fan et al. and Domowitz, Glen, and Madhavan (2000).

<sup>26</sup> Demirguc-Kunt and Maksimovic (1999), Domowitz et al., and Fan et al.

<sup>27</sup> See Domowitz et al.

**Exhibit 6 (Continued)**

<b>Country-Specific Factor</b>	<b>If a Country</b>	<b>... Then D/E Ratio Is Potentially</b>	<b>... And Debt Maturity Is Potentially</b>
<i>Banking system, financial markets</i>			
Equity and bond markets	Has active bond and stock markets		Longer
Bank-based or market-based country	Has a bank-based financial system	Higher	
Investors	Has large institutional investors	Lower	Longer
<i>Macroeconomic environment</i>			
Inflation	Has high inflation	Lower	Shorter
Growth	Has high GDP growth	Lower	Longer

These factors include the differences in the business and legal environments in other countries, taxes, and macroeconomic factors, among others. Companies' optimal capital structures may differ simply as a consequence of these many country-specific differences. In addition to presenting challenges for international financial and credit analysis, these international differences in debt ratios present some challenges in developing debt policies for the foreign subsidiaries of multinational companies. Theory provides little guidance, and corporate practices in this area seem to vary widely.

## SUMMARY

In this reading, we have reviewed theories of capital structure and considered practical aspects that an analyst should examine when making investment decisions.

- The goal of the capital structure decision is to determine the financial leverage that maximizes the value of the company (or minimizes the weighted average cost of capital).
- In the Modigliani and Miller theory developed without taxes, capital structure is irrelevant and has no effect on company value.
- The deductibility of interest lowers the cost of debt and the cost of capital for the company as a whole. Adding the tax shield provided by debt to the Modigliani and Miller framework suggests that the optimal capital structure is all debt.
- In the Modigliani and Miller propositions with and without taxes, increasing a company's relative use of debt in the capital structure increases the risk for equity providers and, hence, the cost of equity capital.
- When there are bankruptcy costs, a high debt ratio increases the risk of bankruptcy.
- Using more debt in a company's capital structure reduces the net agency costs of equity.
- The costs of asymmetric information increase as more equity is used versus debt, suggesting the pecking order theory of leverage, in which new equity issuance is the least preferred method of raising capital.

- According to the static trade-off theory of capital structure, in choosing a capital structure, a company balances the value of the tax benefit from deductibility of interest with the present value of the costs of financial distress. At the optimal target capital structure, the incremental tax shield benefit is exactly offset by the incremental costs of financial distress.
- A company may identify its target capital structure, but its capital structure at any point in time may not be equal to its target for many reasons, including that management may exploit tactical opportunities in financing sources, market-value fluctuations in its securities, or just be unable to maintain the capital structure due to market conditions.
- Many companies have goals for maintaining a certain credit rating, and these goals are influenced by the relative costs of debt financing among the different rating classes.
- In evaluating a company's capital structure, the financial analyst must look at the capital structure of the company over time, the capital structure of competitors that have similar business risk, and company-specific factors, such as the quality of corporate governance, that may affect agency costs, among other factors.
- Good corporate governance and accounting transparency should lower the net agency costs of equity.
- When comparing capital structures of companies in different countries, an analyst must consider a variety of characteristics that might differ and affect both the typical capital structure and the debt maturity structure. The major characteristics fall into three categories: institutional and legal environment, financial markets and banking sector, and macroeconomic environment.

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## PRACTICE PROBLEMS

- 1 If investors have homogeneous expectations, the market is efficient, and there are no taxes, no transactions costs, and no bankruptcy costs, the Modigliani and Miller Proposition I states that:
  - A bankruptcy risk rises with more leverage.
  - B managers cannot change the value of the company by using more or less debt.
  - C managers cannot increase the value of the company by employing tax saving strategies.
- 2 According to Modigliani and Miller's Proposition II without taxes:
  - A the capital structure decision has no effect on the cost of equity.
  - B investment and the capital structure decisions are interdependent.
  - C the cost of equity increases as the use of debt in the capital structure increases.
- 3 Suppose the weighted average cost of capital of the Gadget Company is 10 percent. If Gadget has a capital structure of 50 percent debt and 50 percent equity, a before-tax cost of debt of 5 percent, and a marginal tax rate of 20 percent, then its cost of equity capital is *closest* to:
  - A 12 percent.
  - B 14 percent.
  - C 16 percent.
- 4 The current weighted average cost of capital (WACC) for Van der Welde is 10 percent. The company announced a debt offering that raises the WACC to 13 percent. The *most likely* conclusion is that for Van der Welde:
  - A the company's prospects are improving.
  - B equity financing is cheaper than debt financing.
  - C the company's debt/equity ratio has moved beyond the optimal range.
- 5 All else equal, the use of long-maturity debt is expected to be *greater* in those markets in which:
  - A inflation is low.
  - B capital markets are passive and illiquid.
  - C the legal system's protection of bondholders' interests is weak.
- 6 According to the pecking order theory:
  - A new debt is preferable to new equity.
  - B new debt is preferable to internally generated funds.
  - C new equity is always preferable to other sources of capital.
- 7 According to the static trade-off theory:
  - A debt should be used only as a last resort.
  - B companies have an optimal level of debt.
  - C the capital structure decision is irrelevant.

## The following information relates to Questions 8–13

Barbara Andrade is an equity analyst who covers the entertainment industry for Greengable Capital Partners, a major global asset manager. Greengable owns a significant position with a large unrealized capital gain in Mosely Broadcast Group (MBG). On a recent conference call, MBG's management states that they plan to increase the proportion of debt in the company's capital structure. Andrade is concerned that any changes in MBG's capital structure will negatively affect the value of Greengable's investment.

To evaluate the potential impact of such a capital structure change on Greengable's investment, she gathers the information about MBG given in Exhibit 1.

### Exhibit 1 Current Selected Financial Information for MBG

Yield to maturity on debt	8.00%
Market value of debt	\$100 million
Number of shares of common stock	10 million
Market price per share of common stock	\$30
Cost of capital if all equity-financed	10.3%
Marginal tax rate	35%

Andrade expects that an increase in MBG's financial leverage will increase its costs of debt and equity. Based on an examination of similar companies in MBG's industry, Andrade estimates MBG's cost of debt and cost of equity at various debt-to-total capital ratios, as shown in Exhibit 2.

### Exhibit 2 Estimates of MBG's before Tax Costs of Debt and Equity

Debt-to-Total Capital Ratio (%)	Cost of Debt (%)	Cost of Equity (%)
20	7.7	12.5
30	8.4	13.0
40	9.3	14.0
50	10.4	16.0

- 8 MBG is *best described* as currently:
- A 25% debt-financed and 75% equity-financed.
  - B 33% debt-financed and 66% equity-financed.
  - C 75% debt-financed and 25% equity-financed.
- 9 Based on Exhibit 1, the current after-tax cost of debt for MBG is *closest* to:
- A 2.80%.
  - B 5.20%.
  - C 7.65%.
- 10 Based on Exhibit 1, MBG's current cost of equity capital is *closest* to:
- A 10.30%.

- B** 10.80%.
- C** 12.75%.
- 11** Based on Exhibits 1 and 2, what debt-to-total capital ratio would minimize MBG's weighted average cost of capital?
- A** 20%.
- B** 30%.
- C** 40%.
- 12** Holding operating earnings constant, an increase in the marginal tax rate to 40 percent would:
- A** result in a lower cost of debt capital.
- B** result in a higher cost of debt capital.
- C** not affect the company's cost of capital.
- 13** According to the pecking order theory, MBG's announced capital structure change:
- A** is optimal because debt is cheaper than equity on an after-tax basis.
- B** may be optimal if new debt is issued after new equity is made complete use of as a source of capital.
- C** may be optimal if new debt is issued after internally generated funds are made complete use of as a source of capital.
- 

## The following information relates to Questions 14–19

Lindsay White, CFA, is an analyst with a firm in London, England. She is responsible for covering five companies in the Consumer Staples industry. White believes the domestic and global economies will grow slightly below average over the next two years, but she is also concerned about the possibility of a mild recession taking hold. She has been asked to review the companies that she covers, and she has collected information about them, presented in Exhibit 1. White has estimated that earnings before interest and taxes (EBIT) will remain constant for all five companies for the foreseeable future. Currency is in terms of the British pound (£). The marginal corporate tax rate is 30% for all five companies.

**Exhibit 1 Selected Company Financial Data**

	Aquarius	Bema	Garth	Holte	Vega
EBIT (£)	600,000	600,000	400,000	400,000	400,000
Debt-to-equity ratio (market value)	0.60	0.00	0.00	0.71	0.62
Debt (market value) (£)	2,000,000	0	0	2,000,000	2,000,000
S&P debt rating	A+	n.a.	n.a.	A-	A
Weighted average cost of capital	—	10%	10%	—	—

Based on conversations with management of the five companies, as well as on her own independent research and analysis, White notes the following:

**Aquarius:**

- has lower bonding costs than does Bema.
- has a higher percentage of tangible assets to total assets than does Bema.
- has a higher degree of operating leverage than does Bema.

**Garth:**

- invests significantly less in research and development than does Holte.
- has a more highly developed corporate governance system than does Holte.
- has more business risk than does Holte.

In addition, White has reached various conclusions regarding announcements by Bema, Garth, and Vega:

Announcement      Bema has announced that it will issue debt and use the proceeds to repurchase shares. As a result of this debt-financed share repurchase program, Bema indicates that its debt/equity ratio will increase to 0.6 and its before-tax cost of debt will be 6%.

Conclusion      As a result of the announced program, Bema's total market value should decrease relative to Aquarius's.

Announcement      Garth has announced that it plans to abandon the prior policy of all-equity financing by the issuance of £1 million in debt in order to buy back an equivalent amount of equity. Garth's before-tax cost of debt is 6%.

Conclusion      This change in capital structure is reasonable, but Garth should take care subsequently to maintain a lower D/E ratio than Holte.

Announcement      Vega has announced that it intends to raise capital next year, but is unsure of the appropriate method of raising capital.

Conclusion      White has concluded that Vega should apply the pecking order theory to determine the appropriate method of raising capital.

**14** Based on the Modigliani and Miller (MM) propositions with corporate taxes, Aquarius's WACC is *closest* to:

- A** 3.38%.
- B** 7.87%.
- C** 11.25%.

**15** Based on MM propositions with corporate taxes, what is Bema's weighted average cost of capital after the completion of its announced debt-financed share repurchase program?

- A** 6.52%.
- B** 7.83%.
- C** 8.88%.

**16** Based on Exhibit 1 and White's notes, which of the following is *least* consistent with White's conclusion regarding Bema's announcement?

- A Bema's bonding costs will be higher than Aquarius's.
  - B Bema will have a lower degree of operating leverage than does Aquarius.
  - C Bema will have a lower percentage of tangible assets to total assets than does Aquarius.
- 17 Based on the MM propositions with corporate taxes, Garth's cost of equity after the debt issuance is *closest* to:
- A 10.00%.
  - B 10.85%.
  - C 11.33%.
- 18 Based on Exhibit 1 and White's notes, which of the following is *most* consistent with White's conclusion regarding Garth's announcement?
- A Garth has more business risk than does Holte.
  - B Garth invests significantly less in research and development than does Holte.
  - C Garth has a more highly developed corporate governance system than does Holte.
- 19 Based on White's conclusion regarding determining the appropriate method of raising capital, Vega should raise capital in the following order:
- A debt, internal financing, equity.
  - B equity, debt, internal financing.
  - C internal financing, debt, equity.

## SOLUTIONS

- 1** B is correct. Proposition I, or the capital structure irrelevance theorem, states that the level of debt versus equity in the capital structure has no effect on company value in perfect markets.
  - 2** C is correct. The cost of equity rises with the use of debt in the capital structure, e.g., with increasing financial leverage.
  - 3** C is correct. Using Equation 1 from the reading:
- $$0.10 = (0.50)(0.05)(1 - 0.20) + (0.50)r_e$$
- $$r_e = 0.16 \text{ or } 16 \text{ percent}$$
- 4** C is correct. If the company's WACC increases as a result of taking on additional debt, the company has moved beyond the optimal capital range. The costs of financial distress may outweigh any tax benefits to the use of debt.
  - 5** A is correct. The use of long-maturity debt is expected to be inversely related to the level of inflation.
  - 6** A is correct. According to the pecking order theory, internally generated funds are preferable to both new equity and new debt. If internal financing is insufficient, managers next prefer new debt, and finally new equity.
  - 7** B is correct. The static trade-off theory indicates that there is a trade-off between the tax shield from interest on debt and the costs of financial distress, leading to an optimal amount of debt in a company's capital structure.
  - 8** A is correct. The market value of equity is  $(\$30)(10,000,000) = \$300,000,000$ . With the market value of debt equal to  $\$100,000,000$ , the market value of the company is  $\$100,000,000 + \$300,000,000 = \$400,000,000$ . Therefore, the company is  $\$100,000,000/\$400,000,000 = 0.25$  or 25% debt-financed.
  - 9** B is correct.

$$r_d(1 - t) = 0.08(1 - 0.35) = 0.052 = 5.20\%$$

- 10** B is correct.

$$\begin{aligned} r_e &= r_0 + (r_0 - r_d)(1 - t)\frac{D}{E} \\ &= 0.103 + (0.103 - 0.08)(1 - 0.35)\left(\frac{\$100\text{million}}{\$300\text{million}}\right) \\ &= 0.108 = 10.80\% \end{aligned}$$

- 11** B is correct. Let  $V = D + E$ :

$$r_{wacc} = \left(\frac{D}{V}\right)r_d(1 - t) + \left(\frac{E}{V}\right)r_e$$

$$\begin{aligned} \text{At } D/V = 20\%, r_a &= (0.2)(0.077)(1 - 0.35) + (0.8)(0.125) = 0.1100 \\ &= 11.00\% \end{aligned}$$

$$\begin{aligned} \text{At } D/V = 30\%, r_a &= (0.3)(0.084)(1 - 0.35) + (0.7)(0.130) = 0.1074 \\ &= 10.74\% \end{aligned}$$

$$\begin{aligned} \text{At } D/V = 40\%, r_a &= (0.4)(0.093)(1 - 0.35) + (0.6)(0.140) = 0.1082 \\ &= 10.82\% \end{aligned}$$

$$\begin{aligned} \text{At } D/V = 50\%, r_a &= (0.5)(0.104)(1 - 0.35) + (0.5)(0.160) = 0.1138 \\ &= 11.38\% \end{aligned}$$

- 12** A is correct. The after-tax cost of debt decreases as the marginal tax rate increases.
- 13** C is correct. If internally generated funds have already been fully used, the use of new debt may be optimal, according to the pecking order theory of capital structure.

**14** B is correct.  $V_L = \frac{\text{EBIT}(1-t)}{r_{wacc}}$

Because  $D/E = 0.60$  and  $D = £2m$ , then  $E = £2m/(0.60) = £3,333,333$

So, Value of company ( $V_L$ ) =  $D + E = £2,000,000 + £3,333,333 = £5,333,333$

Because  $V_L = \frac{\text{EBIT}(1-t)}{r_{wacc}} = \frac{(600,000)(1-0.30)}{r_{wacc}} = 5,333,333$

So,  $r_{wacc} = \frac{(600,000)(1-0.30)}{5,333,333} = 0.0787 = 7.87\%$

**15** C is correct.  $r_e = r_0 + (r_0 - r_d)(1-t)\left(\frac{D}{E}\right)$ , and  $r_{wacc} = \left(\frac{D}{V}\right)r_d(1-t) + \left(\frac{E}{V}\right)r_e$

$$\begin{aligned} r_e &= r_0 + (r_0 - r_d)(1-t)\left(\frac{D}{E}\right) = 10 + (10 - 6)(1 - 0.30)(0.60) \\ &= 10 + 1.68 = 11.68\% \end{aligned}$$

Therefore,

$$\begin{aligned} r_{wacc} &= \left(\frac{D}{V}\right)r_d(1-t) + \left(\frac{E}{V}\right)r_e = \left(\frac{0.6}{1.6}\right)(6)(1 - 0.30) + \left(\frac{1.0}{1.6}\right)(11.68) \\ &= 1.58 + 7.30 = 8.88\% \end{aligned}$$

- 16** B is correct. If Bema's degree of operating leverage declines relative to that of Aquarius, Bema's business risk will also decline relative to Aquarius. All else being equal, this decline would be expected to *increase* Bema's market value relative to Aquarius; e.g., by decreasing Bema's cost of equity.

- 17** C is correct.

$$r_e = r_0 + (r_0 - r_d)(1-t)\left(\frac{D}{E}\right)$$

$$V_U = \frac{\text{EBIT}(1-t)}{r_0} = \frac{400,000(1-0.30)}{0.10} = 2,800,000$$

$$V_L = V_U + tD = (2.8 \text{ million}) + (0.30)(1 \text{ million}) = 3.10 \text{ million}$$

$$E = V_L - D = (3.10 \text{ million}) - (1 \text{ million}) = 2.10 \text{ million}$$

$$r_e = r_0 + (r_0 - r_d)(1-t)\left(\frac{D}{E}\right) = 10 + (10 - 6)(1 - 0.30)\left(\frac{1}{2.10}\right)$$

$$= 10 + 1.33 = 11.33\%$$

- 18** A is correct. The statement implies that Garth possesses a lower ability to assume debt than does Holte, all else being equal.
- 19** C is correct. According to the pecking order theory, managers prefer internal financing. If internal financing is not sufficient, managers next prefer debt, and finally equity.



## READING

# 21

## Analysis of Dividends and Share Repurchases

by Gregory Noronha, PhD, CFA, and George H. Troughton, PhD, CFA

*Gregory Noronha, PhD, CFA, is at the University of Washington, Tacoma (USA). George H. Troughton, PhD, CFA (USA).*

### LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. describe the expected effect of regular cash dividends, extra dividends, liquidating dividends, stock dividends, stock splits, and reverse stock splits on shareholders' wealth and a company's financial ratios;
<input type="checkbox"/>	b. compare theories of dividend policy and explain implications of each for share value given a description of a corporate dividend action;
<input type="checkbox"/>	c. describe types of information (signals) that dividend initiations, increases, decreases, and omissions may convey;
<input type="checkbox"/>	d. explain how clientele effects and agency costs may affect a company's payout policy;
<input type="checkbox"/>	e. explain factors that affect dividend policy in practice;
<input type="checkbox"/>	f. calculate and interpret the effective tax rate on a given currency unit of corporate earnings under double taxation, dividend imputation, and split-rate tax systems;
<input type="checkbox"/>	g. compare stable dividend, constant dividend payout ratio, and residual dividend payout policies, and calculate the dividend under each policy;
<input type="checkbox"/>	h. compare share repurchase methods;
<input type="checkbox"/>	i. calculate and compare the effect of a share repurchase on earnings per share when 1) the repurchase is financed with the company's surplus cash and 2) the company uses debt to finance the repurchase;
<input type="checkbox"/>	j. calculate the effect of a share repurchase on book value per share;
<input type="checkbox"/>	k. explain the choice between paying cash dividends and repurchasing shares;

*(continued)*

## LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	I. describe broad trends in corporate payout policies;
<input type="checkbox"/>	m. calculate and interpret dividend coverage ratios based on 1) net income and 2) free cash flow;
<input type="checkbox"/>	n. identify characteristics of companies that may not be able to sustain their cash dividend.

# 1

## INTRODUCTION

This reading covers the features and characteristics of dividends and share repurchases as well as the theory and practice of corporate payout policy. A **dividend** is a distribution paid to shareholders. Dividends are declared (i.e., authorized) by a corporation's board of directors, whose actions may require approval by shareholders (e.g., in most of Europe and in China) or may not require such approval (e.g., in the United States). In contrast to the payment of interest and principal on a bond by its issuer, the payment of dividends is discretionary rather than a legal obligation and may be limited in amount by legal statutes and by debt contract provisions. Dividend payments and interest payments in many jurisdictions are subject to different tax treatment at both the corporate and personal levels.

In this reading, we focus on dividends on common shares (as opposed to preferred shares) paid by publicly traded companies. A company's **payout policy** is the set of principles guiding cash dividends and the value of shares repurchased in any given year. One of the longest running debates in corporate finance concerns the impact of a company's payout policy on common shareholders' wealth.<sup>1</sup> Payout decisions, along with financing (capital structure) decisions, generally involve the board of directors and senior management and are closely watched by investors and analysts.

Dividends and share repurchases concern analysts because, as distributions to shareholders, they affect investment returns and financial ratios. The contribution of dividends to total return for stocks is formidable. For example, the total compound annual return for the S&P 500 Index with dividends reinvested from the beginning of 1926 to the end of 2015 was 10.0%, as compared with 5.8% on the basis of price alone. Similarly, from 1950 to 2015 the Nikkei 225 Index returned 8.3% compounded annually based on price, but 11.5% with dividends reinvested. Dividends also may provide important information about future company performance and investment returns. Analysts should strive to become familiar with all investment-relevant aspects of dividends and share repurchases.

This reading is organized as follows. Section 2 reviews the features and characteristics of cash dividends, liquidating dividends, stock dividends, stock splits, and reverse stock splits and describes their expected effect on shareholders' wealth and a company's financial ratios. Section 3 presents theories of the effects of dividend policy on company value. In Section 4, we discuss factors that affect dividend policy in practice. In Section 5, we cover three major types of dividend policies. Section 6 presents share repurchases, including their income statement and balance sheet

<sup>1</sup> The term *payout policy*, or sometimes *distribution policy*, is more general than *dividend policy* because it reflects the fact that companies can return cash to shareholders by means of share repurchases and cash dividends.

effects and equivalence to cash dividends (under certain assumptions). In Section 7 we present global trends in payout policy. Section 8 covers analysis of dividend safety. The reading concludes with a summary.

## DIVIDENDS: FORMS AND EFFECTS ON SHAREHOLDER WEALTH AND ISSUING COMPANY'S FINANCIAL RATIOS

2

Companies can pay dividends in a number of ways. Cash dividends can be distributed to shareholders through regular, extra (also called special or irregular), or liquidating dividends. Other forms of dividends include stock dividends and stock splits. In this section, we will review the different forms that dividends can take and explain their impact on both the shareholder and the issuing company.

### 2.1 Regular Cash Dividends

Many companies choose to distribute cash to their shareholders on a regular schedule. The customary frequency of payment, however, may vary among markets. In the United States and Canada, most companies that pay dividends choose a quarterly schedule of payments, whereas in Europe and Japan, the most common choice is to pay dividends twice a year (i.e., semiannually). Elsewhere in Asia, companies often favor paying dividends once a year (i.e., annually). Exhibit 1 summarizes typical dividend payment schedules for selected markets.

**Exhibit 1 Geographic Differences in Frequency of Payment of Cash Dividends**

Market	Most Common Frequency
United States and Canada	Quarterly
Europe	Semiannually
Japan	Semiannually
China	Annually
Thailand	Annually

*Source:* Authors' survey of CFA charterholders (June 2009).

Most companies that pay cash dividends strive to maintain or increase their dividends. A record of consistent dividends over a long period of time is important to many companies and shareholders because it is widely interpreted as evidence of consistent profitability. At a minimum, most dividend-paying companies strive not to reduce dividends when they are experiencing temporary problems.

Regular dividends, and especially increasing regular dividends, also signal to investors that their company is growing and will share profits with its shareholders. Perhaps more importantly, management can use dividend announcements to communicate confidence in the company's future. Accordingly, an increase in the regular dividend (especially if it is unexpected) often has a positive effect on share price.

### 2.1.1 Dividend Reinvestment Plans (DRPs)

In some world markets, companies are permitted<sup>2</sup> to have in place a system that allows shareholders to automatically reinvest all or a portion of cash dividends from a company in additional shares of the company. Such a dividend reinvestment plan is referred to as a DRP (pronounced “drip” and therefore often represented also as “DRIP”). Shareholders wishing to participate in a DRP must so indicate to the entity administering it. The three types of DRPs are distinguished by the company’s source of shares for dividend reinvestment:<sup>3</sup>

- an **open-market DRP** in which the company purchases shares in the open market to acquire the additional shares credited to plan participants;
- a **new-issue DRP** (also referred to as a **scrip dividend scheme** in the United Kingdom)<sup>4</sup> in which the company meets the need for additional shares by issuing them instead of purchasing them; and
- plans that are permitted to obtain shares through either open-market purchases or new share issuance.

A company that offers a DRP may experience several benefits. DRPs may encourage a diverse shareholder base by providing small shareholders an easy means to accumulate additional shares. They may stimulate long-term investment in the company because shareholders might value the ability to acquire additional shares. New-issue DRPs allow the company to raise new equity capital without the flotation costs associated with secondary equity issuance using investment bankers. There are also potential advantages to shareholders. DRPs allow the accumulation of shares using cost averaging. Participating shareholders typically have no transaction costs in obtaining the additional shares through a DRP. Some companies, typically new-issue DRPs, offer the additional benefit to DRP participants of purchasing shares at a discount (usually 2–5%) to the market price. Note that such discounts dilute the holdings of shareholders who do not participate in the DRP.

A disadvantage to the shareholder is the extra record keeping involved in jurisdictions where capital gains are taxed. Shares purchased through DRPs change the average cost basis for capital gains tax purposes. If the share price for the reinvested dividend is higher (lower) than the original purchase price, reinvesting the dividend will increase (decrease) the average cost basis. Either way, detailed records must be kept to accurately compute gains or losses when shares are sold. A further disadvantage to the shareholder is that cash dividends are fully taxed in the year received even when reinvested, which means the shareholder is paying tax on cash that is not in hand. For these reasons, use of such plans may be especially appropriate in a tax-deferred account (in which current investment earnings are not taxed), such as certain types of retirement accounts.

## 2.2 Extra or Special (Irregular) Dividends

An **extra dividend** or **special dividend** (also known as an irregular dividend) is a dividend paid by a company that does not pay dividends on a regular schedule or a dividend that supplements regular cash dividends with an extra payment. These extra dividend payments may be brought about by special circumstances. For example, in 2012, management consulting firm Booz Allen Hamilton distributed excess cash

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<sup>2</sup> In some cases, after registering the plan with or gaining approval of the plan from local securities regulators.

<sup>3</sup> See He (2009) for more details.

<sup>4</sup> Sometimes a contrast is drawn between “scrip dividend schemes” and “dividend repurchase plans,” in which the latter term is understood to be only what the text describes as “open-market dividend reinvestment plans.”

through a US\$6.50 extra dividend when the stock price was US\$17.50. This large special dividend occurred at a time when management felt the stock was undervalued. It was financed in part by the restructuring of outstanding debt into a new credit facility.

Companies, particularly in cyclical industries, have sometimes chosen to use special dividends as a means of distributing more earnings only during strong earnings years. During economic downturns, when earnings are low or negative, cash that might otherwise be used for dividends is conserved. For example, a company may choose to declare a small regular dividend and then, when operating results are good, declare an extra dividend at the end of the year. Prior to the recession that began in 2008, which led to the suspension<sup>5</sup> of all Ford Motor Company and General Motors common dividends, Ford and GM often declared moderate regular quarterly dividends and used an “extra dividend” at the end of the year in particularly good earnings years.

Example 1 concerns a company with a stated **dividend policy** (decisions about whether, when, and in what amount to pay dividends) regarding the payment of extra dividends. In the example, the **dividend payout ratio** refers to common share cash dividends divided by net income available to common shares over the same time period.

#### EXAMPLE 1

##### TeliaSonera's Dividend Policy

TeliaSonera AB is the leading provider of telecommunication services in Sweden and Finland. TLSN's financial data are reported in Swedish krona (SEK). In October 2007, TLSN's board of directors modified its dividend policy, stating:

The company shall target a solid investment grade long-term credit rating (A– to BBB+) to secure the company's strategically important financial flexibility for investments in future growth, both organically and by acquisitions. The ordinary dividend shall be at least 40% of net income attributable to shareholders of the parent company. In addition, excess capital shall be returned to shareholders, after the Board of Directors has taken into consideration the company's cash at hand, cash flow projections and investment plans in a medium term perspective, as well as capital market conditions.

*Source: [www.teliasonera.com/investor\\_relations/share\\_data/dividend](http://www.teliasonera.com/investor_relations/share_data/dividend).*

<sup>5</sup> Suspension occurs when a company stops paying any cash dividends.

Selected TLSN Financial per Share Data		
	2008	2007
Shares outstanding	4,490.5 million	4,490.5 million
Earnings per share	SEK4.23	SEK3.94
Cash dividends per share	SEK1.80	SEK4.00

- 1 Calculate the cash dividend payout ratio for 2008 and 2007.
- 2 Assuming the board's new dividend policy became effective in 2008, calculate the amount of the annual ordinary dividend on the basis of TLSN's minimum payout policy in 2008 and the amount that could be considered an extra dividend.

#### Solution to 1:

With the same number of shares outstanding, the dividend payout ratio on a per share basis is dividends per share divided by earnings per share.

For 2008:  $\text{SEK}1.80/\text{SEK}4.23 = 42.6\%$

For 2007:  $\text{SEK}4.00/\text{SEK}3.94 = 101.5\%$

#### Solution to 2:

Under a policy of 40% of earnings, the minimum amount of dividends would be  $\text{SEK}4.23 \times 0.40 = \text{SEK}1.69$ . The amount of the extra dividend would then be  $\text{SEK}1.80 - \text{SEK}1.69 = \text{SEK}0.11$ .

## 2.3 Liquidating Dividends

A dividend may be referred to as a **liquidating dividend** when a company:

- goes out of business and the net assets of the company (after all liabilities have been paid) are distributed to shareholders;
- sells a portion of its business for cash and the proceeds are distributed to shareholders; or
- pays a dividend that exceeds its accumulated retained earnings (impairs stated capital).

These points illustrate that a liquidating dividend is a return of capital rather than a distribution from earnings or retained earnings.

## 2.4 Stock Dividends

Stock dividends are a non-cash form of dividends. With a **stock dividend** (also known as a **bonus issue of shares**), the company distributes additional shares (typically 2–10% of the shares then outstanding) of its common stock to shareholders instead of cash. Although the shareholder's total cost basis remains the same, the cost per share held is reduced. For example, if a shareholder owns 100 shares with a purchase price of \$10 per share, the total cost basis would be \$1,000. After a 5% stock dividend, the shareholder would own 105 shares of stock at a total cost of \$1,000. However, the cost per share would decline to \$9.52 ( $\$1,000/105$ ).

Superficially, the stock dividend might seem an improvement on the cash dividend from both the shareholders' and the company's point of view. Each shareholder ends up with more shares, which did not have to be paid for, and the company did not have to spend any actual money issuing a dividend. Furthermore, stock dividends are generally not taxable to shareholders because a stock dividend merely divides the "pie" (the market value of shareholders' equity) into smaller pieces. The stock dividend, however, does not affect the shareholder's proportionate ownership in the company because other shareholders receive the same proportionate increase in shares. Additionally, the stock dividend does not change the value of each shareholder's ownership position because the increase in the number of shares held is accompanied by an offsetting decrease in earnings per share, and other measures of value per share, resulting from the greater number of shares outstanding.

The second point is illustrated in Exhibit 2, which shows the impact of a 3% stock dividend to a shareholder who owns 10% of a company with a market value of \$20 million. As one can see, the market value of the shareholder's wealth does not change, assuming an unchanged **price-to-earnings ratio** (the ratio of share price, P, to earnings per share, E, or P/E). That assumption is reasonable because a stock dividend does not alter a company's asset base or earning power. (As the reader will see shortly, the same is true of a stock split.) The total market value of the company is unaffected by the stock dividend because the decrease in the share price is exactly offset by the increase in the number of shares outstanding.

### **Exhibit 2 Illustration of the Effect of a Stock Dividend**

	<b>Before Dividend</b>	<b>After Dividend</b>
Shares outstanding	1,000,000	1,030,000
Earnings per share	\$1.00	\$0.97 ( $1,000,000 / 1,030,000$ )
Stock price	\$20.00	\$19.4175 ( $20 \times 0.9709$ )
P/E	20	20
Total market value	\$20 million	\$20 million ( $1,030,000 \times \$19.4175$ )
Shares owned	100,000 ( $10\% \times 1,000,000$ )	103,000 ( $10\% \times 1,030,000$ )
Ownership value	\$2,000,000 ( $100,000 \times \$20$ )	\$2,000,000 ( $103,000 \times \$19.4175$ )

*Note:* The exhibit shows intermediate results rounded to four decimal places, but final results are based on carrying intermediate results at full precision.

The propensity to pay stock dividends varies by market. Stock dividends are very commonly used in China, for example. Some 78% of the companies in the Shanghai A-Share Stock Price Index paid stock dividends in 2009 according to Bloomberg data, whereas an additional 7% of A-Shares had a stock split.

Companies that regularly pay stock dividends see some advantages to this form of dividend payment. It favors long-term investors, which, in turn, may lower the company's cost of equity financing. The payment of a stock dividend also helps increase the stock's float, which improves the liquidity of the shares and dampens share price volatility.

A traditional belief is that a lower stock price will attract more investors, all else equal. US companies often view the optimal share price range as US\$20 to US\$80. For a growing company, a systematic stock dividend will be more likely to keep the stock in the "optimal" range. For example, Tootsie Roll Industries has issued a 3% stock dividend every year except two (2010–2011) since 1966 in addition to its regular

quarterly cash dividend.<sup>6</sup> When the company pays the same dividend rate on the new shares as it did on the old shares, a shareholder's dividend income increases; however, the company could have accomplished the same result by increasing the cash dividend.

From a company's perspective, the key difference between a stock dividend and a cash dividend is that a cash dividend affects a company's capital structure, whereas a stock dividend has no economic impact on a company. Cash dividends reduce assets (because cash is being paid out) and shareholders' equity (by reducing retained earnings). All else equal, liquidity ratios such as the cash ratio (cash and short-term marketable securities divided by current liabilities) and current ratio (current assets divided by current liabilities) should decrease, reflecting the reduction in cash. Financial leverage ratios, such as the debt-to-equity ratio (total debt divided by total shareholders' equity) and debt-to-assets ratio (total debt divided by total assets), should also increase. Stock dividends, on the other hand, do not affect assets or shareholders' equity. Although retained earnings are reduced by the value of the stock dividends paid (i.e., by the number of shares issued  $\times$  price per share), contributed capital increases by the same amount (i.e., the value of the shares issued). As a result, total shareholders' equity does not change. Neither stock dividends nor stock splits (which are discussed in the next section) affect liquidity ratios or financial leverage ratios.

## 2.5 Stock Splits

Stock splits are similar to stock dividends in that they have no economic effect on the company and the shareholders' total cost basis does not change. For example, if a company announces a two-for-one stock split, each shareholder will be issued an additional share for each share currently owned. Thus, a shareholder will have twice as many shares after the split as before the split. Therefore, earnings per share (and all other per share data) will decline by half, leaving the P/E and equity market value unchanged. Assuming the corporation maintains the same dividend payout ratio as before the split, **dividend yield** (annual dividends per share divided by share price) will also be unchanged. Apart from the effect of any information or benefit that investors perceive a stock split to convey, stock splits (like stock dividends) should be neutral in their effect on shareholders' wealth.

Although two-for-one and three-for-one stock splits are the most common, unusual splits, such as five-for-four or seven-for-three, sometimes occur. It is important for shareholders to recognize that their wealth is not changed by the stock split (just as it was not changed for a stock dividend, all else equal). Exhibit 3 shows an example of a two-for-one split and its impact on stock price, earnings per share, dividends per share, dividend payout ratio, dividend yield, P/E, and market value.

**Exhibit 3 Before and After a Two-for-One Stock Split**

	<b>Before Split</b>	<b>After Split</b>
Number of shares outstanding	4 million	8 million
Stock price	€40.00	€20.00 ( $€40/2$ )
Earnings per share	€1.50	€0.75 ( $€1.50/2$ )
Dividends per share	€0.50	€0.25 ( $€0.50/2$ )
Dividend payout ratio	1/3	1/3
Dividend yield	1.25%	1.25% ( $€0.25/€20.00$ )

<sup>6</sup> Tootsie Roll follows a general practice of increasing its cash dividend as well as paying a stock dividend.

**Exhibit 3 (Continued)**

	<b>Before Split</b>	<b>After Split</b>
P/E	26.7	26.7 ( $\text{€}20.00/\text{€}0.75$ )
Market value of equity	€160 million	€160 million ( $\text{€}20.00 \times 8 \text{ million}$ )

As can be seen, a two-for-one stock split is basically the same as a 100% stock dividend because all per share data have been reduced by 50%. The only difference is in the accounting treatment: Although both stock dividends and stock splits have no effect on total shareholders' equity, a stock dividend is accounted for as a transfer of retained earnings to contributed capital. A stock split, however, does not affect any of the balances in shareholder equity accounts.

A company may announce a stock split at any time. Typically, a split is announced after a period in which the stock price has risen. Many investors view the announcement of a stock split as a positive sign pointing to future stock price increases. More often, however, announced stock splits merely recognize that the stock has risen enough to justify a stock split to return the stock price to a lower, more marketable price range.

Several of the largest companies in the world (as measured by market value) had stock splits or large stock dividends in the last decade. For example, Schneider Electric SA (France) had a two-for-one split in 2011; Whole Foods Market (United States) had a two-for-one split in 2013; and Unilever PLC (United Kingdom) had an 80% stock dividend in 2006. In each of these cases, the stock split or the stock dividend came after a significant rise in stock price but was not, in and of itself, a meaningful predictor of future price action.

Much less common than stock splits are reverse stock splits. A **reverse stock split** increases the share price and reduces the number of shares outstanding—again, with no effect on the market value of a company's equity or on shareholders' total cost basis. Just as a high stock price might lead a company to consider a stock split, so too a low stock price may lead a company to consider a reverse stock split. The objective of a reverse stock split is to increase the price of the stock to a higher, more marketable range. As reported in *Barron's*, companies execute reverse splits "to attract institutional investors and mutual funds that often shy from buying stocks trading below US\$5."<sup>7</sup> Reverse stock splits are perhaps most common for companies in, or coming out of, financial distress. As part of its spinoff of its stake in Verizon Wireless, shareholders of Vodafone Group PLC, a global telecommunications company, approved a 6-for-11 reverse stock split effective 24 February 2014. On 21 February, Vodafone shares closed at 161 pence, which implies a post-reverse-split price of about 295 pence. MELA Sciences, a US-based company that produces medical devices to help detect skin cancer, announced a 1-for-10 reverse split effective 10 July 2014 in order to meet minimum share price listing criteria on the NASDAQ Capital Market.

Reverse splits are less common in Asia. For example, reverse stock splits were not permitted in Japan under Corporation Law until 2001.

<sup>7</sup> Furthermore, some brokerages do not permit clients to buy stocks on margin (i.e., with money lent by the brokerage) if the stocks are trading at less than US\$5 per share (see Sears 2009).

**EXAMPLE 2****Citigroup Announces a Planned Reverse Split**

In March 2009, Citigroup, a major US-based global bank, was in severe financial distress and required significant US government investment to avoid bankruptcy. Citigroup announced it would seek shareholder approval for up to a 1-for-30 reverse split. At that time, the stock was perilously close to the US\$1 a share minimum price required for continued listing on the NYSE. In July 2009, the reverse split had not yet taken place but the shares were trading at US\$2.90.

- 1 If the reverse split were to take place when the share price was US\$2.90, find the expected stock price after a 1-for-30 reverse split, assuming no other factors affect the split.
- 2 Comment on the following statement: “Shareholder wealth is negatively affected by a reverse stock split.”

**Solution to 1:**

If the price was US\$2.90 before the reverse split, for every 30 shares, a shareholder would have 1 share priced at  $30 \times \text{US\$2.90} = \text{US\$87}$ .

**Solution to 2:**

The statement is not generally correct. Considering the reverse split on its own, the market capitalization of the common equity would be unchanged. If the reverse split was interpreted as a good decision (e.g., because the company will be able to retain the advantages of being listed on the NYSE), the market capitalization might increase. But other factors—such as continued deterioration of its loan and derivative portfolios or more required government investment leading to further common share dilution—could drive down the stock's value.

**3****DIVIDEND POLICY AND COMPANY VALUE: THEORY**

Since the early 1960s, financial theorists have debated the extent to which dividend policy—the strategy a company follows to determine the amount and timing of dividend payments—should and does matter to a company's shareholders. One group of theorists believes that dividend policy is irrelevant to shareholders. This group typically holds that only the decisions of the company that are directly related to investment in working and fixed capital affect shareholders' wealth. A second group holds that dividend policy does matter to investors, for one or more reasons, and that a company can affect shareholders' wealth through its dividend policy. Typically, dividend relevance is attributed to either the belief that investors value a unit of dividends more highly than an equal amount of uncertain capital gains or to one or more market imperfections. Such imperfections include taxes (because dividends may be taxed differently than capital gains), asymmetric information (corporate insiders are better informed about their company's prospects than outside investors), and agency costs (management has a tendency to squander extra cash). We examine these positions and the assumptions that underlie them in the following subsections.

### 3.1 Dividend Policy Does Not Matter

In a 1961 paper, Miller and Modigliani (“MM”) argued that in a world without taxes, transaction costs, and equal (“symmetric”) information among all investors—that is, under **perfect capital market** assumptions—a company’s dividend policy should have no impact on its cost of capital or on shareholder wealth.<sup>8</sup> Their argument begins by assuming a company has a given capital budget (e.g., it accepts all projects with a positive net present value, or NPV, and that its current capital structure and debt ratio are optimal). Another way of stating this argument is that the dividend decision is independent of a company’s investment and financing decisions. For example, suppose that an all-equity financed company decided to pay as a dividend the investment amount it required for its capital budget. To finance capital projects, the company could issue additional common shares in the amount of its capital budget (such financing would leave its capital structure unchanged). The value of the newly issued shares would exactly offset the value of the dividend. Thus, if a company paid out a dividend that represented 5% of equity, its share price would be expected to drop by 5%. If a common stock in Australia is priced at A\$20 before an A\$1 per share dividend, the implied new price would be A\$19. The shareholder has assets worth A\$20 if the dividend is not paid or assets worth A\$20 if the stock drops to A\$19 and an A\$1 dividend is paid.

Note that under the MM assumptions, there is no meaningful distinction between dividends and share repurchases (repurchases of outstanding common shares by the issuing company): They are both ways for a company to return cash to shareholders. If a company had few investment opportunities such that its current cash flow was more than that needed for positive NPV projects, it could distribute the excess cash flow via a dividend or a share repurchase. Shareholders selling shares would receive A\$20 a share, and shareholders not selling would hold shares whose value continued to be A\$20. To see this, suppose the company being discussed has 10,000 shares outstanding, a current free cash flow of A\$10,000, and a present value of future cash flows is A\$190,000. Thus, the share price is  $(A\$10,000 + A\$190,000)/10,000 = A\$20$ . Now if the company uses the free cash flow to repurchase shares, in lieu of paying a dividend of A\$1, it will repurchase 500 shares ( $A\$10,000/A\$20 = 500$ ). The 9,500 shares left outstanding have a claim on the A\$190,000 future cash flow, which results in a share price of A\$20 ( $A\$190,000/9,500 = A\$20$ ).

An intuitive understanding of MM dividend irrelevance also follows from the concept of a “homemade dividend.”<sup>9</sup> In a world with no taxes or transaction costs, if shareholders wanted or needed income, they could construct their own dividend policy by selling sufficient shares to create their desired cash flow stream. Using the example above, assume the company did not pay the A\$1 dividend and the stock remained at A\$20. A holder of 1,000 shares who desired A\$1,000 in cash could sell 50 shares at A\$20, thus reducing his or her holdings to 950 shares. Note that by reducing share holdings, second-period dividend income is reduced; higher dividend income in one period is at the expense of exactly offsetting lower dividend income in subsequent periods. The irrelevance argument does not state that dividends per se are irrelevant to share value but that dividend *policy* is irrelevant; by taking the earning power of assets as a given and assuming perfect capital markets, policy alternatives merely involve tradeoffs of different dividend streams of equal present value.

<sup>8</sup> See Miller and Modigliani (1961).

<sup>9</sup> MM use a similar idea in their irrelevance proposition for capital structure—that of “homemade leverage.” If a shareholder can undo anything a company does at no cost, then it follows that whatever the company does in terms of capital structure or dividend decisions should not have an impact on shareholder value because the shareholder can always alter the outcome to suit his or her own needs. Thus under the MM assumptions, only investment decisions, which determine the amount of future cash flows from operations, have an effect on company value.

In the real world, market imperfections create some problems for MM's dividend policy irrelevance propositions. First, both companies and individuals incur transaction costs. A company issuing new shares incurs **flotation costs** (i.e., costs in selling shares to the public that include underwriters' fees, legal costs, registration expenses, and possible negative price effects) often estimated to be as much as 4% to 10% of the capital raised, depending on the size of the company and the size of the issue.<sup>10</sup> Shareholders selling shares to create a "homemade" dividend would incur transaction costs and, in some countries, capital gains taxes (of course, cash dividends incur taxes in most countries). Furthermore, selling shares on a periodic basis to create an income stream of dividends can be problematic over time if share prices are volatile. If share prices decline, shareholders have to sell more shares to create the same dividend stream.

### 3.2 Dividend Policy Matters: The Bird in the Hand Argument

Financial theorists—such as Myron Gordon (1963), John Lintner (1962), and Benjamin Graham (1934)—have argued that, even under perfect capital markets assumptions, investors prefer a dollar of dividends to a dollar of potential capital gains from reinvesting earnings because they view dividends as less risky. Graham's viewpoint is that ". . . the typical dollar of reinvestment has less economic value to the shareholder than a dollar paid in dividends."<sup>11</sup> The Gordon, Lintner, and Graham arguments are similar and have sometimes been called the "bird in the hand" argument, a reference to the proverb "a bird in the hand is worth two in the bush." By assuming that a given amount of dividends is less risky than the same amount of capital gains, the argument is that a company that pays dividends will have a lower cost of equity capital than an otherwise similar company that does not pay dividends; the lower cost of equity should result in a higher share price. MM contend that this argument is incorrect because, under their assumptions, paying or increasing the dividend today does not affect the risk of future cash flows. Such actions only lower the **ex-dividend** price of the share.

### 3.3 Dividend Policy Matters: The Tax Argument

In some countries, dividend income has traditionally been taxed at higher rates than capital gains. For instance in the 1970s, tax rates on dividend income in the United States were as high as 70%, whereas the long-term capital gains rate was 35%. Even as recently as 2002, US tax rates were as high as 39.1% on dividends and 20% on long-term capital gains. After 2012, dividends on shares held for at least 60 days have been taxed at a maximum rate of 20% in the United States, which exceeds the long-term capital gains tax rate of 15%.

An argument could be made that in a country that taxes dividends at higher rates than capital gains, taxable investors should prefer companies that pay low dividends and reinvest earnings in profitable growth opportunities. Presumably, any growth in earnings in excess of the opportunity cost of funds would translate into a higher share price. If, for any reason, a company lacked growth opportunities sufficient to consume its annual retained earnings, it could distribute such funds through share repurchases (again, the assumption is that capital gains are taxed more lightly than dividends). Taken to its extreme, this argument would advocate a *zero* dividend payout ratio. Real world market considerations may complicate the picture. For example, in some

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<sup>10</sup> Because net income is calculated after payment of interest, net income is considered a flow to equity or internally generated equity. New share issuance—externally generated equity—is thus the closest financing substitute to internally generated equity. Dividends also may be financed with debt (if bond covenants permit), which can be subject to flotation costs.

<sup>11</sup> See Graham, Dodd, Cottle, and Tatham (1962).

jurisdictions governmental regulation may require companies to distribute excess earnings as dividends or to classify share repurchases as dividends if the repurchases appear to be ongoing in lieu of dividend payments.

### 3.4 Other Theoretical Issues

In the following section, we present additional perspectives related to the theory of dividend policy.

#### 3.4.1 Clientele Effect

Another factor that may affect a company's dividend policy is a clientele effect. In this context, a **clientele effect** is the existence of groups of investors (clienteles) attracted to (and drawn to invest in) companies with specific dividend policies.

For example, some retired investors may have a preference for higher current income and prefer to hold stocks with relatively high dividend payouts and yields. Alternatively, other investor groups, such as younger workers with a long time horizon, might favor owning shares of companies that reinvest a high proportion of their earnings for long-term capital growth and thus prefer stocks that pay little or no dividends.

When the investor's marginal tax rate on capital gains (i.e., the tax on the next euro of capital gains) is lower than the marginal tax rate on dividends (i.e., the tax on the next euro of dividends), the investor may be influenced by tax considerations to have a preference for returns in the form of capital gains. All else being equal, however, tax-exempt investors would be expected to be indifferent about returns in the forms of capital gains or dividends from a tax perspective. Taxable investors might be similarly indifferent regarding investments held in tax-exempt accounts.

Many investors indicate a preference for dividends. Some institutional investors—including certain mutual funds, banks, and insurance companies—will invest only in companies that pay a dividend. Some investors require a specific minimum dividend yield or require that the dividend yield be in the top quartile (or half) of the relevant stock universe. Some mutual funds and exchange-traded funds specifically seek high-dividend yield. Various high-yield equity indexes exist in response to this demand (e.g., the Dow Jones Dividend Index family or the MSCI High Dividend Yield Indexes). Trusts and foundations may be under a restriction that only income (i.e., interest and dividends) may be distributed to beneficiaries. Some individual investors use a discipline of "only spend the dividends, not the principal" to preserve their capital.<sup>12</sup> Furthermore, some jurisdictions have *legal* or *approved lists of equity investments* for institutions, such as insurance companies, or trusts for individuals. Such lists typically mandate that permissible investments consist only of companies that pay dividends. Often, such restrictive lists are intended to discourage investment in high-risk stocks. All of these considerations suggest that a clientele effect does exist and that equity market participants can be sorted by those who prefer to receive returns in the form of dividends and those who prefer capital gains returns.

Even if a clientele effect exists, however, it would not follow that dividend policy affects equity values, rather that investors care about dividends and gravitate toward owning companies with the dividend policies they prefer. In particular, if the dividend market is in equilibrium in the sense that the demands of all clienteles for various dividend policies are satisfied by sufficient numbers of companies, a company cannot affect its own share value by changing its dividend policy. The change would result only in a switch in clientele. Thus, dividend clienteles may tend to promote stability of dividend policy and do not contradict dividend policy irrelevance.

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<sup>12</sup> See Shefrin and Statman (1984).

Investors seeking yield will often be found to consistently overweight some industry sectors relative to the benchmark weights of those sectors. Exhibit 4 shows the dividend yield for eight of the MSCI All-Country World industry sectors.

As is evident, there are substantial differences in dividend yields for these eight industries, with Utilities having the highest yield and Technology and Consumer goods having relatively low ones.

**Exhibit 4 Gross Dividend Yield on Selected MSCI All-Country World Sector Indexes (Percent)**

**Industries**

Oil and gas	3.5
Basic materials	4.0
Consumer goods	2.0
Health care	2.5
Consumer services	3.0
Financials	3.1
Utilities	4.3
Technology	1.6

Source: Morningstar (August 2014).

If the tax rates applied to dividends and capital gains are the same, then the expected price drop when a share goes **ex-dividend** is, holding all else constant, the amount of the dividend. When the ex-dividend day price change is consistently different from that amount, the discrepancy may carry information about the marginal tax rates of investors trading in the share on the **ex-dividend date**. The point is worth developing in greater detail.

Suppose that a taxable investor purchases a share at price  $P_b$  (where  $b$  is for *buy*) and has marginal tax rates on dividends and capital gains of  $T_D$  and  $T_{CG}$ , respectively. Consider two trading strategies distinguished by whether a share is sold just before or just after the share goes ex-dividend:

- *Sell just before the share goes ex-dividend.* The share is sold at the end of the last trading day before the ex-dividend day at price  $P_w$  (where  $w$  is for *with right to receive the dividend*). By selling the share at that time, the investor will *not* appear as a holder of record of the share as of the record date and will *not* be entitled to the dividend. (The purchaser of the share will be the owner of record.)

The resulting cash flow is the sale price  $P_w$  minus the capital gains tax owed on the sale:  $P_w - (P_w - P_b)(T_{CG})$

- *Sell just after the share goes ex-dividend.* The share is sold when it opens for trading on the ex-dividend day at price  $P_x$  (where  $x$  is for *ex-dividend*). The investor will receive the dividend.

The resulting cash flow is the sale price  $P_x$  minus the capital gains tax owed on the sale plus the after-tax amount of the dividend:

$$P_x - (P_x - P_b)(T_{CG}) + D(1 - T_D)$$

A **marginal investor** in a given share is defined as an investor who is very likely to be part of the next trade in the share and who is therefore important in setting the price. Suppose that the investor whose marginal tax rates we are describing is such

an investor. The prices  $P_w$  and  $P_x$  represent an equilibrium if this marginal investor is indifferent about selling the share just before and just after it goes ex-dividend. For that to be the case, the two cash flows given must be equal:

$$P_w - (P_w - P_b)(T_{CG}) = P_x - (P_x - P_b)(T_{CG}) + D(1 - T_D)$$

This equation can be solved for the amount of the price decrease when the share goes ex-dividend,  $P_w - P_x$ :<sup>13</sup>

$$P_w - P_x = D \frac{1 - T_D}{1 - T_{CG}} \quad (1)$$

Equation 1 implies three relationships. If the investor's marginal tax rate on dividends is equal to the marginal tax rate on capital gains, the share's price should drop by the amount of the dividend when the share goes ex-dividend. If the investor's marginal tax rate on dividends is higher than the marginal tax rate on capital gains, the share's price should drop by less than the amount of the dividend when the share goes ex-dividend. Finally, if the investor's marginal tax rate on dividends is less than the marginal tax rate on capital gains, the share's price should drop by more than the amount of the dividend when the share goes ex-dividend. For example, if the dividend is €12 and the marginal tax rate on dividends at 0.40 is higher than the marginal tax rate on capital gains at 0.20, we expect the price to drop by less than the amount of the dividend on the ex-dividend day. The expected price drop is calculated as  $(€12)(1 - 0.40)/(1 - 0.20) = (€12)(0.75) = €9$ .

The ratio  $(1 - T_D)/(1 - T_{CG})$  can be viewed as establishing an indifference relationship between dividends and capital gains. For example, assuming an investor pays taxes of 40% on the next unit of dividend income and taxes of 15% on the next unit of capital gains, €1 of dividend is worth as much as  $(1 - 0.40)/(1 - 0.15) = €0.71$  in capital gains.

The amount of the ex-dividend price drop may provide information on the tax rates applying to those trading in the stock. Example 3 shows details about this type of analysis.

### EXAMPLE 3

#### Clientele and Preferences for Dividends versus Capital Gains

- 1 An individual investor pays taxes of 28% on the next dollar of dividend income and taxes of 15% on the next dollar of capital gains. Which would she prefer: \$1 in dividends or \$0.87 in capital gains?
- 2 Suppose the tax rate on capital gains is 20% for all investors, but the tax rate on dividend income differs among investors. A share drops by 70% of the amount of the dividend, on average, when the share goes ex-dividend. Assume that any appropriate corrections for equity market price movements on ex-dividend days have been made. Calculate the marginal tax rate on dividend income applying to those who trade the issue around the ex-dividend day.
- 3 Consider a US corporation with a corporate income tax rate of 40%. The corporation needs to report as taxable income only 30% of dividends received from other corporations; that is, it takes a 70% deduction on that

<sup>13</sup> See Elton and Gruber (1970). Technically, the expression does not take into account the time value of money and assumes investors are risk neutral (indifferent to risk).

type of dividend income in calculating taxes owed. Assume that both capital gains and reported dividends (dividends net of any deductible amount) are taxed at 40%. What is US\$1 of dividends worth in terms of capital gains for such a corporate investor?

- 4 Explain why the ex-dividend share price would be expected to drop by more than the amount of the dividend if such investors as the corporation described in question 3 are the marginal trader in the issue.
- 5 For a given share issue, the share price consistently drops by an amount very close to the amount of the dividend when the share goes ex-dividend. Describe the marginal investor in the shares.

#### **Solution to 1:**

For this investor, \$1 in dividends results in \$0.72 [ $\$1 \times (1 - 0.28) = \$0.72$ ] after taxes, and \$0.87 in capital gains results in \$0.74 [ $\$0.87 \times (1 - 0.15) = \$0.74$ ] after taxes. Thus, the investor would prefer \$0.87 in capital gains to \$1 in dividends.

#### **Solution to 2:**

The statement of the problem implies that  $(P_w - P_x)/D = 0.70$ . Thus,  $0.70 = (1 - T_D)/(1 - T_{CG}) = (1 - T_D)/(1 - 0.20)$ . So,  $(0.80)(0.70) = 1 - T_D$  and  $T_D = 1 - (0.80)(0.70) = 0.44$ . The average ex-dividend day price movement reflects a 44% marginal tax rate on dividend income for those who trade around the ex-dividend day.

#### **Solution to 3:**

Because 70% of the dividend is excluded from taxation, the effective tax rate on dividends,  $T_D$ , is  $0.4(1 - 0.7) = 0.12$ . Thus, a US\$1 dividend is worth  $(1 - 0.12)/(1 - 0.4) = \text{US\$}1.47$  of capital gains for the corporate investor described.

#### **Solution to 4:**

Because 70% of the dividends received are excluded from taxation, the corporation has a tax-motivated preference for dividends over capital gains. Therefore, the ratio  $(1 - T_D)/(1 - T_{CG})$  exceeds 1.0; that is,  $(P_w - P_x) > D$ . The ex-dividend day price decline is expected to exceed the amount of the dividend.

#### **Solution to 5:**

The marginal investor may be a tax-exempt investor. A taxable investor with the same marginal tax rate on dividends and capital gains is another possibility consistent with the data.

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The existence of dividend clienteles does not contradict the hypothesis of dividend policy irrelevance. Example 4 addresses the point.

#### **EXAMPLE 4**

#### **Clienteles and Preferences for Dividends versus Capital Gains**

Suppose it is established that about 70% of investors prefer a relatively high income stream from a given size position in shares. You are on the board of directors of a company with a dividend policy that specifies a particularly low dividend payout ratio. Give two reasons why having your company adopt a higher dividend payout ratio may not lead to an increase in shareholder wealth.

**Solution:**

First, even if the dividend payout ratio is not increased, individual shareholders may be able to manufacture their desired income stream by selling shares as needed (creating “homemade dividends”). Second, if there are tax clienteles, by adopting a higher dividend payout ratio the company may be merely exchanging one clientele (which it satisfies currently) for a different clientele.

**3.4.2 The Information Content of Dividend Actions: Signaling**

MM assumed that all investors—including outside investors—have the same information about the company: a situation of symmetric information. In reality, corporate managers typically have access to more detailed and extensive information about the company than do outside investors.

A situation of asymmetric information raises the possibility that dividend increases or decreases may affect share price because they may convey new information about the company. A company’s board of directors and management, having more information than outside investors, may use dividends to signal to investors about (i.e., convey information on) the company’s prospects. A company’s decision to initiate, maintain, increase, or cut a dividend may convey more credible information than positive words from management because cash is involved. For a signal to be effective, it must be difficult or costly to mimic by another entity without the same attributes. Dividend increases are costly to mimic because a company that does not expect its cash flows to increase will not be able to maintain the dividend at increasingly high levels in the long run.<sup>14</sup> (In the short run, a company may be able to borrow to fund dividends.)

Empirical studies broadly support the thesis that dividend initiations or increases convey positive information and are associated with future earnings growth, whereas dividend omissions or reductions convey negative information and are associated with future earnings problems.<sup>15</sup> A dividend declaration can help resolve some of the information asymmetry between insiders and outsiders and help close any gap between the market price of shares and their intrinsic value. In a study of US equities, Healy and Palepu (1988) found that company earnings increased by an average of 43% in the year of dividend initiation and 164% in the subsequent four years. Furthermore, the announcement of the initiation of a regular cash dividend was accompanied by an excess return of 4% on average. Example 5 provides further support for the idea that dividend initiations contain value-relevant information.

**EXAMPLE 5****Information on Dividend Initiations**

- A** Oracle Corporation, a leading business software maker, initiated a US\$0.05 quarterly dividend in May 2009. Oracle’s annual US\$0.20 dividend amounts to about US\$1 billion, a relatively small amount compared with operating cash flow of US\$8 billion and another US\$9 billion in cash and cash-equivalent assets on its balance sheet at the end of fiscal year

<sup>14</sup> See, for example, Ross (1977); Myers and Majluf (1984).

<sup>15</sup> See Filbeck (2009) for a short summary of the evidence, including the evidence that does not support the thesis stated.

2009. An analyst who follows Oracle for institutional investors saw the Oracle announcement as a signal that the company is well positioned to ride out the downturn and also gain market share.<sup>16</sup>

- B** In mid-2009, Paris-based Groupe Eurotunnel announced its first ever dividend after it completed a debt restructuring and received insurance proceeds resulting from a fire that had closed the Channel Tunnel. In a 2 June 2009 press release, Eurotunnel's CEO said that this "marked a turning point for the company as its business has returned to the realm of normality" as the company anticipated a return to profitability.

Some researchers<sup>17</sup> have argued that a company's dividend initiation or increase tends to be associated with share price increases because it attracts more attention to the company. Managers have an incentive to increase the company's dividend if they believe the company to be undervalued because the increased scrutiny will lead to a positive price adjustment. In contrast, according to this line of reasoning, managers of overvalued companies have little reason to mimic such a signal because increased scrutiny would presumably result in a downward price adjustment to their shares.

#### EXAMPLE 6

#### Signaling with Dividends and the Costs of Mimicking

Suppose that the management of a company with poor future prospects recommends to the board of directors an increase in its dividend. Management explains to the board that investors may then believe that the company has positive future prospects, leading to an increase in share value and shareholder wealth.

- 1 State whether such imitation is likely to achieve the stated objective over the long term.
- 2 Justify your answer to Question 1.

#### Solution to 1:

No, such dividend increases are not likely to achieve the stated objective over the long term for the company described.

#### Solution to 2:

Dividend increases are costly to mimic because a company that does not expect its cash flows to increase will not be able to maintain the increased dividend. The company will have to either cut the dividend in the future or go to the market to obtain new equity or debt funding to pay the dividend. Both these alternatives are costly for the company because they result in downward revisions, on average, to the stock price.

Many companies take pride in their record of consistently increasing dividends over a long period of time. Standard & Poor's, for example, identifies companies in its US-based S&P 500 Index, Europe 350 Index, Pan Asia Index, and S&P/TSX Canadian Index that are "Dividend Aristocrats" in the sense that they have increased their dividend for a number of consecutive years (at least 25 years in the case of the S&P

<sup>16</sup> See *Wall Street Journal* (19 March 2009, B1).

<sup>17</sup> See Grinblatt, Masulis, and Titman (1984).

500, at least 10 years in the case of the Europe 350, at least 7 years in the case of Pan Asia Index, and at least 5 years in the case of the S&P/TSX). These companies are in various industries and include, as of February 2016, ExxonMobil, McDonalds, Procter & Gamble, Walmart, Novartis, Siemens, Total SA, BHP Billiton, Thai Beverage, and Wharf Holdings, among others. When a company's earnings and cash flow outlook has been and continues to be positive, it often views a policy of increasing dividends as an important tool to convey that information to existing and potential shareholders. Companies that consistently increase their dividends seem to share certain characteristics:

- Dominant or niche positions in their industry
- Global operations
- Relatively less volatile earnings
- Relatively high returns on assets
- Relatively low debt ratios (dividend payouts unlikely to be affected by restrictions in debt covenants)

Dividend cuts or omissions, in contrast, present powerful and often negative signals. For companies under financial or operating stress, the dividend declaration date may be viewed with more than usual interest. Will they cut the dividend? Will they omit the dividend altogether? In these instances, merely maintaining the dividend or not cutting it as much as expected is usually viewed as good news (i.e., that current difficulties are transitory and manageable), unless investors view managers as trying to convey erroneous information to the market.

In principle, management can attempt to send a positive signal by cutting the dividend, although that is difficult in practice. For example, IBM, long the giant of mainframe computers and a company with an enviable record of dividend increases over the years, announced in 1993 a more than 50% cut in its dividend. IBM explained that its intention was to use the funds conserved to shift its business into non-mainframe technology and consulting services for the purpose of improving future returns. Although the message was met with varying reactions, it was, in retrospect, a positive signal because IBM successfully used its cash flow to reorganize its business. IBM resumed its dividend increases again in 1996 and, as of the time of this writing, it has increased every year since.

## **EXAMPLE 7**

### **Dividend Reductions and Price Increases**

On 6 March 2003, the BBC reported that Royal & Sun Alliance Group, Britain's second largest insurer, had announced it would cut its dividend from 16 pence a share to 6 pence a share. The company also revealed that it had a shortfall of £406 million in its pension fund and was planning to increase contributions to the fund by about £30 million a year for the next 10 years.

All this was despite the fact that the company reported operating profits of £226 million at the end of 2002, up from just £16 million at the end of 2001. The insurer was in the process of reorganizing its business to focus on general insurance policies, and expanding into Australia and New Zealand—all while replacing its chief executive. The interim chief executive told reporters that future dividends would depend on decisions made by the new leadership. As the market digested all this information, the insurance company's shares rose 2%.

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*Source:* BBC News, <http://news.bbc.co.uk/2/hi/business/2824527.stm>.

Another even more complicated example of the signaling content of dividends can be found in Microsoft's initial dividend declaration. As Exhibit 4 showed, technology companies have among the lowest dividend yields and, it can be shown, below-average dividend payout ratios. These facts make sense. Most technology companies have high R&D requirements and some (e.g., integrated circuit manufacturers) are capital intensive; those that are profitable often achieve returns on assets and owners' equity that are well above average. In addition, business risk is considerable as discoveries and unforeseen advances change the product landscape. All of these considerations would suggest a policy of low (or no) dividend payments, so that internally generated funds are directed for new product development and capital investment that will maintain high returns. Some companies in the technology sector, however, do mature. For example, in the mid-1990s, because of Microsoft's past phenomenal growth and its dominance of its industry, net cash grew to tens of billions of dollars. Many wondered if the company could effectively use its cash "hoard" and if it was time for Microsoft to pay a dividend.

In late 2003, Microsoft declared its first annual dividend of US\$0.06 a share, equaling about 7% of its yearly cash flow, less than 2% of its net cash position, and representing a yield of 0.3%. Then, in the summer of 2004, the company increased its annual dividend to US\$0.32 a share and announced a special year-end dividend of US\$3.00 a share. Some investors viewed these declarations positively, whereas others viewed them negatively. On the one hand, some believed that Microsoft was signaling an interest in broadening its investor focus while refraining from undertaking unprofitable expansion. The clientele effect, discussed earlier, would suggest that Microsoft's dividend possibly attracted a new group of potential shareholders. On the other hand, others viewed the dividend declaration as an admission that it was becoming a mature company—that it could no longer reap high returns from reinvesting its earnings. The future growth prospects for the stock, they would argue, had been diminished, although a question was the extent to which the market already understood that. Regardless, few could argue that the 2003–2004 dividend declarations by Microsoft were not corporate events of some importance.

### 3.4.3 Agency Costs and Dividends as a Mechanism to Control Them

Large, publicly traded corporations typically have a substantial separation between the professional managers who control the corporation's operations and the outside investors who own it. When agents (the managers) and owners (the shareholders) are two separate parties, managers may have an incentive to maximize their own welfare at the company's expense because they own none or relatively small percentages of the company for which they work and thus do not bear all the costs of such actions. This incentive is ultimately also a problem of unequal (asymmetric) information between managers and outside investors because, if outside investors could perfectly observe managers, managers would be dissuaded from such actions. One managerial incentive of particular concern is the potential private benefit managers may obtain from investment in negative net present value (NPV) projects. Such projects will generate negative economic returns; but because they may grow the size of the company (measured in sales or assets) and thus enlarge the manager's span of control, the manager may have the incentive to invest in them. This is a particular problem when management's compensation is tied to assets or sales rather than value enhancement, a flaw in the firm's corporate governance. The potential overinvestment agency problem might be alleviated by the payment of dividends. In particular, by paying out all free cash flow

to equity in dividends, managers would be constrained in their ability to overinvest by taking on negative NPV projects.<sup>18</sup> This concern or hypothesis that management may create an overinvestment agency cost is known as Jensen's free cash flow hypothesis.<sup>19</sup>

The potential for managers to squander free cash flow by undertaking unprofitable projects is a consideration to be evaluated on a case-by-case basis. For example, as discussed previously, Microsoft accumulated increasingly large cash positions but was not observed to squander monies on unprofitable projects. In some cases, such cash positions may provide financial flexibility to respond quickly to changes in the environment, to grasp unforeseen opportunities, or to survive periods of restricted credit, as in the case of Ford Motor Company's accumulation of cash during profitable years in the 1990s. Clearly, there are industry-specific and life-cycle conditions to consider. In general, it makes sense for growing companies in industries characterized by rapid change to hold cash and pay low or no dividends, but it does not make sense for large, mature companies in relatively non-cyclical industries. In general, there is empirical support for the market reaction to dividend change announcements to be stronger for companies with greater potential for overinvestment than for companies with lesser potential for overinvestment.<sup>20</sup>

Another concern when a company is financed by debt as well as equity is that paying dividends can exacerbate the agency conflict between shareholders and bondholders. When a company has debt outstanding, the payment of dividends reduces the cash cushion available to the company for the disbursement of fixed required payments to bondholders. The payment of large dividends, with the intention of transferring wealth from bondholders to shareholders, could lead to underinvestment in profitable projects. All else equal, both dividends and share repurchases increase the default risk of debt. Reflecting bondholders' concern, the bond indenture (contract) often includes a covenant restricting distributions to shareholders that might impair the position of bondholders.<sup>21</sup> A typical form of this restriction is to define the maximum allowable amount of distributions to shareholders during the life of the bond. This amount of funds is usually a positive function of the company's current and past earnings and issues of new equity and a negative function of dividends paid since the bonds were issued. Such covenants often do not really restrict the level of dividends as long as those dividends come from new earnings or from new issues of stock. What the covenant attempts to do is prevent the payment of dividends financed by the sale of the company's existing assets or by the issuance of new debt. Covenants that specify minimum levels of EBITDA and/or EBIT coverage of interest charges are frequently used as well. These covenants provide some assurance that operating earnings include a cushion for the payment of fixed charges.<sup>22</sup> Other covenants focus on balance sheet strength—for example, by specifying a maximum value for the ratio of debt to tangible net worth.

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<sup>18</sup> Informally, free cash flow to equity is the cash flow available to be distributed as dividends after the company has accepted all positive NPV projects.

<sup>19</sup> See Jensen (1986).

<sup>20</sup> For more information, see Mukherjee (2009).

<sup>21</sup> This discussion draws on Smith and Warner (1979).

<sup>22</sup> EBITDA and EBIT are earnings before interest, taxes, depreciation, and amortization and earnings before interest and taxes, respectively. Bond covenants typically indicate that EBITDA and EBIT are adjusted for nonrecurring items.

**EXAMPLE 8****Agency Issues and Dividends**

Two dividend-paying companies A and B directly compete with each other. Both companies are all-equity financed and have recent dividend payout ratios averaging 35%. The corporate governance practices at Company B are weaker than at Company A. For example, at B but not A, the chief executive officer is also chairperson of the board of directors. Recently, profitable investment opportunities for B have become fewer, although operating cash flow for both A and B is strong.

Based only on the information given, investors who own shares in both A and B are *most likely* to press for a dividend increase at:

- A Company A, because it has better growth prospects than Company B.
- B Company B, because a dividend increase may mitigate potential overinvestment agency problems.
- C Company B, because a dividend increase may mitigate potential underinvestment agency problems.

**Solution:**

B is correct. Company B's strong operating cash flow in an environment of fewer profitable growth opportunities may tempt Company B's management to overinvest. The concern is increased because of Company B's relatively weak corporate governance.

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The final example in this section illustrates the complex agency considerations that may affect dividend policy.

**EXAMPLE 9****Electric Utilities, Agency Costs, and Dividends**

Electric utilities often have above average dividend yields. A distinctive characteristic of many utility companies is that they pay a high percentage of earnings as dividends, while periodically issuing new equity to invest in the many projects necessitated by the capital-intensive nature of their business. This practice of financing dividends with new equity appears unwise because new equity is expensive. Researchers<sup>23</sup> examining a set of US-based electric utilities, however, have demonstrated that there may be a good reason for paying dividends and then issuing equity: the mitigation of the agency problems between managers and shareholders and between utility regulators and utility shareholders.

Because electric utilities are typically monopolies in the sense that they are usually the only providers of electricity in a given area, they are regulated so they are not able to set electricity rates at monopolistically high levels. The regulators are expected to set rates such that the company's operating expenses are met and investors are provided with a fair return. The regulators, however, are usually elected, or are political appointees, and view ratepayers as potential voters. Thus, utility shareholders, in addition to facing potential manager-shareholder

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<sup>23</sup> See Hansen, Kumar, and Shome (1994).

agency issues because managers have incentives to consume perquisites or to overinvest, also face a regulator–shareholder conflict in which regulators set rates low to attract the votes of individuals being served by the utility.

In the utility industry, therefore, dividends and the subsequent equity issue are used as mechanisms to monitor managers and regulators. The company pays high dividends and then goes to the capital markets to issue new equity. If the market does not think that shareholders are getting a fair return because regulators are setting rates too low, or because managers are consuming too many perks, the price at which new equity can be sold will fall until the shareholder expectations for returns are met. As a result, the company may not be able to raise sufficient funds to expand its plant to meet increasing electricity demand—the electric utility industry is very capital intensive—and, in the extreme, customer needs may not be met. Faced with this possibility, and potentially angry voters, regulators have incentives to set rates at a fair level. Thus, the equity market serves to monitor and arbitrate conflicts between shareholders and both managers and regulators.

### 3.5 Dividend Theory: Summary

What can we conclude about the link between dividends and valuation? In theory, in the absence of market imperfections, Miller and Modigliani (1961) find that dividend policy is irrelevant to the wealth of a company’s investors. But in reality, the existence of market imperfections makes matters more complicated. In addition, some investors are led, by logic or custom, to prefer dividends.

Unfortunately, in the search for the link between dividend policy and value, the evidence is inconclusive. It is difficult to show an exact relationship between dividends and value because there are so many variables affecting value. We have presented factors that would seem to explain why some companies put emphasis on dividends and others do not. Financial theory predicts that reinvestment opportunities should be the dominant factor. Indeed, no matter where they are located in the world, small, fast-growing companies pay out little or none of their earnings. Regardless of jurisdiction, more mature companies with fewer reinvestment opportunities tend to pay dividends. For these mature companies, taxes, regulations/laws, tradition, signaling, ownership structure, and attempts to reconcile agency conflicts all seem to play a role in determining the dividend payout ratio. At a minimum, in looking at a company, an analyst should evaluate whether a given company’s dividend policy matches its reinvestment opportunities, clientele preferences, and legal/financial environment.

## FACTORS AFFECTING DIVIDEND POLICY IN PRACTICE

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In Section 3 we discussed theories of dividend policy and value and concluded that the issue is, at best, unresolved. In this section we explore six factors that affect a company’s **dividend policy**, which we defined earlier as decisions about whether, when, and in what amount to pay dividends:

- Investment opportunities
- The expected volatility of future earnings
- Financial flexibility
- Tax considerations

- Flotation costs
- Contractual and legal restrictions

Boards of directors and managers spend considerable time setting dividend policy despite the lack of clear guidance from theory to inform their deliberations. The factors listed are, however, often mentioned by managers themselves as relevant to dividend policy selection in practice. Some of the factors we explore, such as taxation, are not company-specific, whereas other factors, such as possible contractual restrictions on dividend payments and the expected volatility of future earnings, are more company-specific. The factors may be interrelated, and the presence of one may enhance or diminish the effect of another. Importantly, the independence between the investment, financing, and dividend decisions assumed by MM may no longer hold when such market imperfections as information effects, agency problems, and taxes are recognized.

## 4.1 Investment Opportunities

All else equal, a company with many profitable investment opportunities will tend to pay out less in dividends than a company with fewer opportunities because the former company will have more uses for internally generated cash flows. Internally generated cash flow is generally a cheaper source of equity funding than new equity issuance. Opportunities for new investments, and the speed with which a company needs to respond to them, are influenced by the industry in which the company operates. A company with the ability to delay the initiation of projects without penalty may be willing to pay out more in dividends than a company that needs to act immediately to exploit profitable investment opportunities. From Exhibit 4, we saw that technology companies have much lower average dividend yields than utilities. The chief explanation may be the size and time horizon of profitable investment opportunities in relation to annual operating cash flow generated. For technology companies the pace of change is rapid, so having internally generated funds available to react to profitable opportunities affords them valuable flexibility. For utility companies, for which there are typically fewer such opportunities and for which change is much slower, higher dividend payouts are indicated.

## 4.2 The Expected Volatility of Future Earnings

In 1956, Lintner<sup>24</sup> published a survey of managers at 28 companies that identified several important factors in the dividend payout decision. Most managers:

- had a target payout ratio based on long-run sustainable earnings;
- focused more on dividend changes (increases or decreases) than on dividend levels; and
- were reluctant to increase the dividend if the increase might soon need to be reversed.

More recently, Brav et al. (2005), in a survey of treasurers and chief financial officers, reported that managers are very reluctant to cut dividends and tend to smooth dividends.<sup>25</sup> Smoothing takes the form of relating dividend increases to the long-term earnings growth rate, even if short-term earnings are volatile. All else equal, the more

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<sup>24</sup> Lintner (1956).

<sup>25</sup> Brav, Graham, Harvey, and Michaely (2005).

volatile earnings are, the greater the risk that a given dividend increase may not be covered by earnings in a future time period. Thus, when earnings are volatile, we expect companies to be more cautious in the size and frequency of dividend increases.

### **4.3 Financial Flexibility**

Companies may not initiate, or may reduce or omit, dividends to obtain the financial flexibility associated with having substantial cash on hand. A company with substantial cash holdings is in a relatively strong position to meet unforeseen operating needs and to exploit investment opportunities with minimum delay. Having a strong cash position can be particularly valuable during economic contractions when the availability of credit may be reduced. Financial flexibility may be viewed as a tactical consideration that is of greater importance when access to liquidity is critical and when the company's dividend payout is relatively large.

A classic example of explaining a dividend decision in terms of the need to preserve financial flexibility occurred on 28 February 2009 when General Electric Company, which had not reduced its dividend at any time in the previous 71 years, announced that going forward it was cutting its quarterly dividend rate from US\$0.31 to US\$0.10. GE Chairman Jeffrey Immelt stated:

We made the decision to cut the dividend because it is a prudent measure to further enhance our balance sheet and provide us with flexibility for potential future opportunities. It is the right, precautionary action to keep the company safe and secure in the difficult operating environment we see today. We believe it further strengthens our Company for the long-term, while still providing an attractive dividend.

*Source:* [www.gereports.com/jeff-immelt-talks-about-ges-dividend](http://www.gereports.com/jeff-immelt-talks-about-ges-dividend).

The cut was expected to conserve US\$9 billion on an annual basis. With approximately US\$50 billion of cash on hand at the time of the statement and with operating cash flow at least covering the previous dividend, the dividend reduction appeared to be accurately characterized as "precautionary." Nevertheless, the dividend cut was widely anticipated<sup>26</sup> despite the assurance in GE's February 2009 Investor Update (2 February 2009) that "We are committed to our plan for US\$1.24 per share dividend for 2009" (page 1). Furthermore, most analysts had a favorable response to GE's decision to cut the dividend given the uncertainty about the magnitude of credit losses at its financing division, GE Capital, the duration of the economic contraction, and partially frozen credit markets.

When increasing financial flexibility is an important concern, a company may decide to distribute money to shareholders primarily by means of share repurchases (covered in Section 6) rather than regular dividends. A program to repurchase shares in the open market does not involve a formal requirement that any repurchases be executed, and share repurchases in general do not establish the same expectations for continuation in the future as regular dividends.

### **4.4 Tax Considerations**

Taxation is an important factor that affects investment decisions for taxable investors in particular, because it is the after-tax return that is most relevant to investors. Different jurisdictions tax corporate dividends in a wide variety of ways. Some tax

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<sup>26</sup> The precipitous decline in GE's share repurchases in the preceding quarter indicated to many investors an urgent concern for conserving cash.

both capital gains and dividend income. Others tax dividends but not capital gains. Even within a given country, taxation can be quite complex. In addition, because taxation is a major fiscal policy tool that is subject to politics, governments have a tendency to “re-address” tax issues, sometimes with great frequency. As with other aspects of taxation, governments use the taxation of dividends to address a variety of goals: to encourage or discourage the retention or distribution of corporate earnings; to redistribute income; or to address other political, social, and/or investment goals.

For the global investor, foreign taxes can be as important as domestic taxes. Foreign tax credits in the investor’s home country also may figure importantly into the overall taxation issue. For example, France requires companies domiciled in France to withhold 30% of dividends paid to foreign investors, but investors in the United States can claim a tax credit on their US tax return for the amount of that tax.

#### 4.4.1 Taxation Methods

We look at three main systems of taxation that determine dividends: double taxation, imputation, and split-rate. Other tax systems can be a combination of these.

In a **double taxation system**, corporate pretax earnings are taxed at the corporate level and then taxed again at the shareholder level if they are distributed to taxable shareholders as dividends. Exhibit 5 illustrates double taxation. The United States is used as an example. In 2003, the individual tax rate on dividends was lowered from a maximum of 39.6% (the highest marginal income tax rate) to a maximum of 15% (it has since been raised to 20%).<sup>27</sup> Also in 2003, the tax rate on long-term capital gains was reduced from a 20% maximum rate to 15%. Exhibit 5 depicts the double taxation system using the highest marginal rate on dividends in the United States both before and after the 2003 tax law change.

**Exhibit 5 Double Taxation of Dividends at Different Personal Tax Rates (per US\$100)**

	39.6%	15.0%
Net income before taxes	US\$100	US\$100
Corporate tax rate	35%	35%
Net income after tax	US\$65	US\$65
Dividend assuming 100% payout	US\$65	US\$65
Shareholder tax on dividend	US\$25.74	US\$9.75
Net dividend to shareholder	US\$39.26	US\$55.25
Double tax rate on dividend distributions*	60.7%	44.8%

\* Based on pretax income. For the case of the 39.6% personal tax rate, we have  $(\text{US\$100} - \text{US\$39.26})/\text{US\$100} = 60.7\%$

Although there is still double taxation of dividends before and after the 2003 tax change, the net tax rate on a dollar of income distributed in dividends declined from 61% to 45%: a decline of about 26%. US investors clearly prefer the lower tax rate on dividends, but it is not clear whether they prefer a higher or lower payout because

<sup>27</sup> For this lower maximum tax rate to apply, the dividends must meet certain criteria such that they are considered to be “qualified dividends.” For dividends to be qualified for this tax rate, they must be out of accumulated taxable earnings of the corporation. Also, recipients of dividends must meet certain minimum holding periods during which they have not hedged away the economic risk of the security held.

the tax rate was the same on both dividends and long-term capital gains for most shareholders. Later, we will discuss a company's decision with respect to the dividend payout ratio.

A second major taxation system is the **dividend imputation tax system**, which effectively ensures that corporate profits distributed as dividends are taxed just once, at the shareholder's tax rate. Australia and New Zealand use a dividend imputation tax system. Under this system, a corporation's earnings are first taxed at the corporate level. When those earnings are distributed to shareholders in the form of dividends, however, shareholders receive a tax credit, known as a **franking credit**, for the taxes that the corporation paid on those distributed earnings (i.e., corporate taxes paid are imputed to the individual shareholder). If the shareholder's marginal tax rate is higher than the company's, the shareholder pays the difference between the two rates. Exhibit 6 shows one variation of a tax imputation system in which a shareholder with a lower marginal tax bracket than the company's actually receives a tax credit for the difference between the corporate rate and his own rate.

#### Exhibit 6 Taxation of Dividends Based on Tax Imputation System (A\$)

	<b>Marginal Shareholder Tax Rate</b>	
	<b>15%</b>	<b>47%</b>
Pretax income	A\$100	A\$100
Taxes at 30% corporate tax rate	30	30
Net income after tax	70	70
Dividend assuming 100% payout	70	70
Shareholder tax on pretax income	15	47
Less tax credit for corporate payment	30	30
Tax due from shareholder	(15)	17
Effective tax rate on dividend	15/100	47/100
	= 15%	= 47%

A **split-rate tax system** is a third taxation system of greater historical than current importance. Under this system, corporate earnings that are distributed as dividends are taxed at a lower rate at the corporate level than earnings that are retained. At the level of the individual investor, dividends are taxed as ordinary income. Earnings distributed as dividends are still taxed twice, but the relatively low corporate tax rate on earnings mitigates that penalty. Exhibit 7 depicts this split-rate tax system for dividends.

#### Exhibit 7 Taxation of Dividends Based on Split-Rate System (per €100)

Pretax earnings	€200
Pretax earnings retained	100
35% tax on retained earnings	35
Pretax earnings allocated to dividends	100
20% tax on earnings allocated to dividends	20
Dividends distributed	80
Shareholder tax rate	35%

*(continued)*

**Exhibit 7 (Continued)**

After tax dividend to shareholder	$[(1 - 0.35) \times 80] = 52$
Effective tax rate on dividend	$[20\% + (80 \times 0.35)\%] = 48\%^*$

\* Note that of every €100 allocated to dividends, the shareholder receives €52, which implies that the effective tax rate on dividends is  $(100 - 52)/100 = 48\%$ .

#### 4.4.2 Shareholder Preference for Current Income versus Capital Gains

All other things being equal, one could expect that the lower an investor's tax rate on dividends relative to his or her tax rate on capital gains, the stronger the investor's preference for dividends. But other issues also impinge on this preference. The investor may buy high-payout shares for a tax-exempt retirement account. Even if dividends are taxed at a lower rate than capital gains, it is not clear that shareholders will necessarily prefer higher dividends. After all, capital gains taxes do not have to be paid until the shares are sold, whereas taxes on dividends must be paid in the year received, even if reinvested. In addition, in some countries, such as the United States, shares held at the time of death benefit from a step-up valuation as of the death date.<sup>28</sup> Finally, tax-exempt institutions, such as pension funds and endowment funds, are major shareholders in most industrial countries. Such institutions are typically exempt from both taxes on dividends and taxes on capital gains. Hence, all other things being equal, they are indifferent as to whether their return comes in the form of current dividends or capital gains.

## 4.5 Flotation Costs

Another factor that affects a company's dividend policy is flotation costs. Flotation costs include 1) the fees that the company pays (to investment bankers, attorneys, securities regulators, auditors, and others) to issue shares and 2) the possible adverse market price impact from a rise in the supply of shares outstanding. Aggregate flotation costs are proportionally higher (in terms of percentage of gross proceeds) for smaller companies (which issue fewer shares) than for larger companies. Flotation costs make it more expensive for companies to raise new equity capital than to use their own internally generated funds. As a result, many companies try to avoid establishing a level of dividends that would create the need to raise new equity to finance positive NPV projects.<sup>29</sup>

### EXAMPLE 10

#### A Company That Needs to Reinvest All Internally Generated Funds

Boar's Head Spirits Ltd., based in the United Kingdom, currently does not pay a dividend on its common shares. Boar's Head has an estimated operating cash flow of £500 million. The company's financial analyst has calculated its cost of capital as 12%. The same analyst has evaluated modernization and expansion projects with a positive NPV that would require £800 million. The cost of positive NPV projects exceeds estimated operating cash flow by £300 million (£800 million

<sup>28</sup> The tax basis of the shares received by the beneficiary from the decedent is stepped up to fair market value at the date of death of the decedent.

<sup>29</sup> We mentioned this earlier. There are companies, however, that pay dividends and issue equity, mainly in the utility industry. For a further discussion, see Parrino and Kidwell (2017).

– £500 million). Having an above average debt ratio for its industry, Boar's Head is reluctant to increase its long-term debt in the next year. Discuss whether you would expect Boar's Head to initiate a dividend based on the above facts.

**Solution:**

One would expect Boar's Head would not initiate a dividend. As things stand, internally generated funds, as represented by operating cash flow, are not sufficient to fund positive NPV projects. So payment of a dividend would be at the expense of rejecting positive NPV projects unless the balance of such projects and the dividend were both financed by debt. Given its concern about debt levels, the company would not be expected to pay a dividend that needs to be financed by debt. Because the company has unfunded positive NPV projects, it could consider issuing new shares to fund those projects. The company, however, would not be expected to issue shares solely for the purpose of paying dividends.

The solution to Example 10 can also be stated in terms of free cash flow to equity (FCFE). FCFE equals cash flow from operations (CFO) minus fixed capital investment (FCInv) for the period (capital expenditures) plus net borrowing for the period. Conceptually, FCFE is the cash flow available for the payment of dividends, and in this case it is negative:  $FCFE = \text{£}500 \text{ million} - \text{£}800 \text{ million} + \text{Net borrowing} = -\text{£}300 \text{ million} + \text{Net borrowing}$ , which is negative for values of net borrowing below £300 million.

## 4.6 Contractual and Legal Restrictions

The payment of dividends is often affected by legal or contractual restrictions or rules. In some countries, such as Brazil, the distribution of dividends is legally mandated (with certain exceptions).<sup>30</sup> In other countries (e.g., Canada and the United States) the payment of a dividend not specifically indicated to be a liquidating dividend may be restricted by an **impairment of capital rule**. Such a rule requires that the net value of the remaining assets as shown on the balance sheet be at least equal to some specified amount (related to the company's capital).

Contractual restrictions on the amount of dividends that can be paid are often imposed by bondholders in bond indentures.<sup>31</sup> These restrictions require that the company maintain certain ratios (interest coverage ratios, current ratio, etc.) or fulfill certain conditions before dividend payments can be made. Debt covenants in a bond indenture are a response to the agency problems that exist between shareholders and bondholders and are put in place to limit the ability of the shareholders to expropriate wealth from bondholders. As an extreme example, in the absence of covenants or legal restrictions,<sup>32</sup> management could liquidate the company's assets and pay the proceeds to the shareholders as a liquidating dividend, leaving the bondholders with nothing to settle their claims.

If a company has issued preference shares, dividends on common shares may not be paid until preference share dividends are paid. In addition, if the preference dividends are cumulative, then preference dividends that are in arrears must be paid before any common dividend can be paid.

<sup>30</sup> See [www.mzweb.com.br/positivo/web/conteudo\\_en.asp?idIoma=1&tipo=3667&conta=44#1](http://www.mzweb.com.br/positivo/web/conteudo_en.asp?idIoma=1&tipo=3667&conta=44#1).

<sup>31</sup> An **indenture** is a written contract between a lender and borrower that specifies the terms of the loan, such as interest rate, interest payment schedule, or maturity.

<sup>32</sup> An example of a legal restriction is a law against fraudulent transfer of assets.

## 4.7 Factors Affecting Dividend Policy: Summary

Several factors of varying degrees of importance can affect a company's dividend policy. In the following example, we explore how these factors affected Toyota Motor Company's dividend policy.

### EXAMPLE 11

#### Toyota Motor Company Cuts Its Dividend<sup>33</sup>

On 8 May 2009, Toyota Motor Company, the world's largest automobile manufacturer, announced that it was going to cut its dividend for the first time. Toyota, which pays dividends twice a year, said the dividend would be reduced to ¥35 a share from the ¥75 paid a year earlier. The 2008 total dividend was ¥140 a share. The dividend cut ends a 600% cumulative increase in the dividend over 10 years. Faced with plunging global demand for cars (Toyota's vehicle sales were forecasted to fall 14%) and ongoing turmoil in the auto industry, Toyota was expecting a loss as high as ¥550 billion (operating loss of ¥850 billion) for fiscal year ending March 2010, compared with the analyst forecasted loss of ¥284 billion for the same period. The company already had a loss of ¥437 billion in fiscal year 2009 (the operating loss was ¥461 billion). Toyota is focused on aggressively cutting costs—it plans to cut production-related costs by ¥340 billion and fixed costs by ¥460 billion—and has said that the lower dividend is because of the difficulty of sustaining the dividend at its previous level. Board member bonuses have been eliminated, and manager summer bonuses were reduced by 60%. Capital spending will be cut by 36 percent to ¥830 billion, and R&D spending will be cut by 9.3% to ¥820 billion.

The company announced plans to raise capital via a bond issue of as much as ¥700 billion. Standard & Poor's cut Toyota's bond rating from AA+ to AA. Because of the importance of exports, another problem facing Toyota and other Japanese automakers was the strong yen, which gained 13% against the US dollar in the preceding quarter.

Discuss Toyota's decision to cut its dividend in light of the factors affecting dividend policy covered in this section.

#### Solution:

Of the six factors discussed in this section, the *volatility of future earnings* and preservation of *financial flexibility* are the major factors influencing Toyota's decision to cut its dividend. Paying the full dividend would have lowered Toyota's liquidity ratios and forced it to raise even more external capital. In addition, paying the full dividend probably would have resulted in a more severe downgrade in its bond rating and an increase in the cost of debt financing. Paying the full dividend when faced with huge, larger than expected operating losses also might have sent a signal to investors that Toyota was not serious about cutting costs and curtailing losses. *Flotation costs* could also play a role in Toyota's case. Flotation costs on new equity are typically higher than those on new debt; it is possible that if it paid a dividend of more than ¥35 a share it would have to issue new equity in addition to the ¥700 billion in debt.

<sup>33</sup> Source: [www.bloomberg.com](http://www.bloomberg.com).

## PAYOUT POLICIES

5

In the following sections we discuss three types of dividend policies: stable dividend, constant dividend payout ratio, and residual dividend policies. A **stable dividend policy** is one in which regular dividends are paid that generally do not reflect short-term volatility in earnings. This type of dividend policy is the most common because managers are very reluctant to cut dividends, as discussed earlier. A **constant dividend payout ratio policy** is the policy of paying out a constant percentage of net income in dividends. A **residual dividend policy** is based on paying out as dividends any internally generated funds remaining after such funds are used to finance positive NPV projects. This type of policy often has been mentioned in theoretical discussions of dividend policy but is rarely used in practice. In Section 6, we discuss share repurchases, as an alternative to the payment of cash dividends.

### 5.1 Stable Dividend Policy

This dividend policy is the most common. Companies that use a stable dividend policy base dividends on a long-term forecast of sustainable earnings, and increase dividends when earnings have increased to a sustainably higher level. Thus, if the long-term forecast for sustainable earnings is slow growth, the dividends would be expected to grow slowly over time, more or less independent of cyclical upward or downward spikes in earnings. If sustainable earnings were not expected to grow over time, however, the corresponding dividends would be level (i.e., not growing). Compared with the two other types of dividend policies that will be presented, a stable dividend policy typically involves less uncertainty for shareholders about the level of future dividends. This is so because the other types of policies reflect to a higher degree short-term volatility in earnings and/or in investment opportunities.

Many companies pride themselves on a long record of gradually and consistently increasing dividends. Exhibit 8 shows the record of E.ON AG, Europe's largest utility. Dividends per share (DPS) show an upward trajectory. The decline in earnings in 2008 was actually accompanied by an increase in dividends, underscoring the long-term perspective of a stable dividend policy. To explain further, the exhibit shows adjusted earnings per share (EPS) reported by E.ON that attempt to remove "special effects" (to use the language of the annual report), such as restructuring expenses, marking to market of derivatives, and so on. In 2008, earnings were severely affected by book losses on disposals. For the long term, E.ON management was obviously optimistic about earnings prospects.

**Exhibit 8 E.ON AG Earnings and Dividends**

Year	EPS (€)	EPS (adjusted)	DPS (€)	Dividend Payout Ratio (%))	Dividend Payout Ratio Using Adjusted EPS (%))
2008	0.68	€3.01	1.50	221	50
2007	3.69	€2.62	1.37	37	52
2006	2.82	€2.22	1.12	40	50
2005	3.75	€1.84	0.92	25	50
2004	2.20	n/c	0.78	35	n/c

Source: [www.eon.com/en/investoren/19886.jsp](http://www.eon.com/en/investoren/19886.jsp).

As the example shows, dividends over the period were fairly stable, even while earnings, affected by restructuring costs, experienced considerable variability.

A stable dividend policy can be modeled as a process of gradual adjustment towards a target payout ratio based on long-term sustainable earnings. A **target payout ratio** is a goal that represents the proportion of earnings that the company intends to distribute (pay out) to shareholders as dividends over the long term.

A model of gradual adjustment (which may be called a “target payout adjustment model”) was developed by John Lintner.<sup>34</sup> The model reflects three basic conclusions from his study of dividend policy: 1) Companies have a target payout ratio, based on long-term, sustainable earnings; 2) managers are more concerned with dividend changes than with the level of the dividend; and 3) companies will cut or eliminate a dividend only in extreme circumstances or as a last resort.

A simplified version of Lintner’s model can be used to show how a company can adjust its dividend.<sup>35</sup> For example, suppose that the payout ratio is below the target payout ratio and earnings are expected to increase. The expected increase in the dividend can be estimated as a function of four variables: expected earnings next year, the target payout ratio, the previous dividend, and the adjustment factor (one divided by the number of years over which the adjustment in dividends should take place). Suppose that the current dividend is \$0.40, the target payout ratio is 50%, the adjustment factor is 0.2 (i.e., the adjustment is to occur over five years), and expected earnings are \$1.50 for the year ahead (an increase from the \$1 value of last year). The expected increase in dividends is \$0.07, as shown below:

Expected increase in dividends

$$\begin{aligned} &= (\text{Expected earnings} \times \text{Target payout ratio} - \text{Previous dividend}) \times \text{Adjustment factor} \\ &= (\$1.50 \times 0.5 - \$0.40) \times 0.2 \\ &= \$0.07 \end{aligned}$$

Therefore, even though earnings increased 50% from \$1.00 to \$1.50, the dividend would only incrementally increase by about 17.5% from \$0.40 to \$0.47.

By using this model, note that if in the following year earnings temporarily fell from \$1.50 to \$1.34, the dividend might well be increased by up to \$0.04  $[(\$1.34 \times 0.5 - \$0.47) \times 0.2 = \$0.04]$  a share, because the implied new dividend of \$0.51 would still be moving the company toward its target payout ratio of 50%. Even if earnings were to fall further or even experience a loss, the company would be reluctant to cut or eliminate the dividend (unless its estimate of sustainable earnings or target payout ratio were lowered); instead, it would rather opt to maintain the current dividend until future earnings increases justified an increase in the dividend.

### EXAMPLE 12

#### Determining Dividends by Using a Target Payout Adjustment Model

Last year Luna Inc. had earnings of US\$2.00 a share and paid a regular dividend of US\$0.40. For the current year, the company anticipates earnings of US\$2.80. It has a 30% target payout ratio and uses a 4-year period to adjust the dividend. Compute the expected dividend for the current year.

<sup>34</sup> Lintner (1956).

<sup>35</sup> Lease et al. (2000).

**Solution:**

$$\begin{aligned}
 \text{Expected dividend} &= \text{Previous dividend} + [(\text{Expected earnings} \times \\
 &\quad \text{Target payout ratio} - \text{Previous dividend}) \times \\
 &\quad \text{Adjustment factor})] \\
 &= \$0.40 + [(\$2.80 \times 0.3 - \$0.40) \times (1/4)] \\
 &= \$0.40 + (\$0.84 - \$0.40) \times (1/4)) \\
 &= \$0.51 \text{ Dividend, an } \$0.11 \text{ increase}
 \end{aligned}$$

Thus, although earnings are expected to increase by 40%, the increase in the dividend would be 27.5%. Despite the adjustment process, the payout ratio would fall from 20% (US\$0.40/US\$2.00) to 18.2% (US\$0.51/US\$2.80). The firm would move toward its target payout ratio if earnings growth were slower and the adjustment time period were shorter (i.e., the adjustment factor higher).

## 5.2 Constant Dividend Payout Ratio Policy

In this type of policy, a dividend payout ratio decided on by the company is applied to current earnings to calculate the dividend. With this type of dividend policy, dividends fluctuate with earnings in the short term. Constant dividend payout ratio policies are infrequently adopted in practice. Example 13 illustrates this type of policy.

### EXAMPLE 13

#### Cal-Maine Foods Changes from a Stable to a Constant Dividend Payout Ratio Policy

Cal-Maine Foods, Inc., is the leading egg producer in the United States. Cal-Maine's earnings tend to be highly volatile. Demand for eggs is seasonal, typically being higher in winter than in summer. On the supply side, costs are driven, to a great extent, by corn prices that are subject to business cycle influences and are thus very volatile. In consideration of earnings volatility, Cal-Maine might have difficulty sustaining a steadily rising dividend level. Probably in view of such considerations, Cal-Maine changed its dividend policy from a stable dividend policy to a constant dividend payout ratio policy (denoted a "variable dividend policy" by management) in its fiscal year 2008. The following is the explanation by the company:

We have paid cash dividends on our Common Stock since 1998. The annual dividend rate of US\$0.05 per share of Common Stock, or US\$0.0125 per quarter, was paid in each of the fiscal quarters shown in the table above, through the second quarter of fiscal 2008. We have also paid cash dividends on our Class A Common Stock at a rate equal to 95% of the annual rate on our Common Stock.

Effective 30 November 2007, the Company's Board of Directors approved the adoption of a variable dividend policy to replace the Company's fixed dividend policy. Commencing with the third quarter of fiscal 2008, Cal-Maine began to pay a dividend to shareholders of its Common Stock and Class A Common Stock on a quarterly basis for each quarter for which the Company reports net income computed in accordance with generally accepted accounting principles in an amount equal to one-third (1/3) of such quarterly income. The amount of the dividend payable on each share of Class A Common Stock is in an amount equal to 95% of the amount paid on each share

of Common Stock. Dividends are paid to shareholders of record as of the sixtieth day following the last day of such quarter, and are payable on the fifteenth day following the record date. Following a quarter for which the Company does not report net income, the Company shall not pay a dividend for a subsequent profitable quarter until the Company is profitable on a cumulative basis computed from the date of the last quarter for which a dividend was paid.

Management and Board of Directors of Cal-Maine believe the variable dividend policy will more accurately reflect the results of our operations while recognizing and allowing for the cyclical nature of the egg industry.

*Source:* www.calmainefoods.com.

Exhibit 9 shows quarterly data for fiscal years 2009 and 2008.

**Exhibit 9 Earnings per Share (EPS) and Dividends per Share (DPS) for Cal-Maine Foods (Fiscal Years End 31 or 30 May)**

Fiscal Period	EPS(US\$)	DPS(US\$)
2009:Q4	0.43	0.1438
2009:Q3	1.30	0.4322
2009:Q2	1.15	0.3817
2009:Q1	0.47	0.1570
2008:Q4	1.54	0.5138
2008:Q3	2.41	0.8038
2008:Q2	1.70	0.0125
2008:Q1	0.76	0.0125

*Source:* www.calmainefoods.com.

- From the table above, identify the fiscal quarter when Cal-Maine first applied a constant dividend payout ratio policy.
- Demonstrate that the dividend for 2009:Q4 reflects the stated current dividend policy.

**Solution to 1:**

Cal-Maine first used that policy in the third quarter of fiscal year 2008. Until then, a quarterly dividend of US\$0.0125 was paid no matter what the quarterly earnings per share were. The payout ratios in all subsequent quarters round to approximately 33.3%.

**Solution to 2:**

$(\text{EPS US\$}0.43)/3 = \text{US\$}0.1433$ , which differs only slightly from the reported dividend of US\$0.1438 (EPS are rounded to two decimal places, so rounding error is expected).

### 5.3 Residual Dividend Policy

The **residual dividend policy** is an intuitively appealing dividend policy that is rarely used in practice because it typically results in highly volatile dividend payments. The residual dividend policy is based on paying out as dividends the full amount of any internally generated funds remaining after financing the current period's capital expenditures (investment in positive net present value projects) consistent with the target capital structure. A residual dividend policy presumes that equity financing comes from reinvested earnings rather than new share issuance, which is more expensive. Directing internally generated funds first to positive NPV projects is consistent with shareholder wealth maximization as is, typically, distributing to shareholders the balance that cannot be so invested. The residual dividend policy puts investment in positive NPV projects ahead of considerations of not reducing the dividend. Under a residual dividend policy, however, dividends may swing from low or zero when capital expenditure needs are high (relative to internally generated funds) to high when the reverse situation holds. The increased uncertainty about future dividends may lead investors to require a higher rate of return on equity investment as compensation, possibly offsetting any advantages to the policy.

Exhibit 10 provides an illustration of the residual dividend policy. The company has earnings of €100 million, a target capital structure of 30% debt and 70% equity, and three prospective capital expenditure levels of €50 million, €100 million, and €150 million. As Exhibit 10 shows,  $\text{Dividend} = \text{Residual earnings} = \text{Earnings} - (\text{Capital budget} \times \text{Equity percent in capital structure})$  or zero, whichever is greater.

**Exhibit 10 Residual Dividend Policy for a Target Capital Structure of 30% Debt and 70% Equity (€ millions)**

	€50 Capital Budget	€100 Capital Budget	€150 Capital Budget
Earnings	€100	€100	€100
Capital spending	€50	€100	€150
Financed from new debt	$0.3 \times 50 = €15$	$0.3 \times 100 = €30$	$0.3 \times 150 = €45$
Financed from retained earnings	$0.7 \times 50 = €35$	$0.7 \times 100 = €70$	$0.7 \times 150 > 100 \Rightarrow €100$
Financed from new equity or debt	€0	€0	€5
Residual earnings = residual paid	$€100 - €35 = €65$	$€100 - €70 = €30$	$€100 - €100 = €0$
Implied payout ratio	$65/100 = 65\%$	$30/100 = 30\%$	$0/100 = 0\%$

In the final column of Exhibit 10, the €150 million in capital spending requires €105 million in equity ( $€150 \text{ million} \times 0.70$ ), which is greater than the company's total earnings of €100 million. The company would probably finance the shortfall with debt, temporarily deviating from its target capital structure, rather than use more costly external equity financing.

As can be seen from Exhibit 10, various capital spending plans result in dramatically different implied dividend payments. Payout ratios, too, range from a zero payment of dividends under the highest capital spending plan, to a 65% payout ratio under the lowest capital spending plan.

To overcome the problem of volatile dividends, companies may use a long-term residual dividend approach to smooth their dividend payments. The approach would involve forecasting earnings and capital expenditures over the next 5 or 10 years, determining the resulting total amount of residual dividends for the period, which would then be paid out evenly over the forecast period. The company could also set

a relatively low stable cash dividend based on the calculation and distribute a more flexible amount to shareholders in the form of share repurchases or even a special dividend as in the Microsoft case described earlier.

#### EXAMPLE 14

### Determining Dividends

- 1 Suppose a company has €900 million in planned capital spending (representing positive NPV projects). The company's target capital structure is 60% debt and 40% equity. Given that the company follows a residual dividend policy, the company's indicated dividend with earnings of €500 million, is *closest* to:
  - A €140 million.
  - B €360 million.
  - C €500 million.
- 2 Suppose a company has paid semiannual dividends of €3 a share over the prior two years and €2.75 for four years prior to that. During that six-year period, earnings and capital expenditure needs have shown considerable interim variability, and dividend payout ratios have ranged from 55 to 86%, with an average of 65%. In the current six-month period, suppose that 8 million shares are issued and outstanding and that earnings are anticipated to be €28 million. The company has €5 million in planned capital spending for the six-month period (representing positive NPV projects). The company's long-term target capital structure is 50% debt and 50% equity. Based on the facts given, and assuming the company follows a stable dividend policy, the most likely dividend per share for the current six-month period is:
  - A €2.28.
  - B €3.00.
  - C €3.19.

#### Solution to 1:

A is correct. To fund its €900 million in projects while maintaining its target debt ratio of 60%, the company will obtain  $\text{€900 million} \times 0.60 = \text{€540 million}$  in new debt financing. The amount that needs to be financed by internally generated funds is  $\text{€900 million} - \text{€540 million} = \text{€360 million}$ . Netting that amount from earnings gives  $\text{€500 million} - \text{€360 million} = \text{€140 million}$  that can be paid out in dividends. The solution can also be obtained as  $\text{€500} - (\text{€900} \times 0.4) = \text{€500} - \text{€360} = \text{€140 million}$ .

#### Solution to 2:

B is correct. The historical description of the company's dividend payments is consistent with a stable dividend policy. The total cost of the dividend at 8 million shares  $\times$  €3 a share = €24 million, which is covered by current earnings of €28 million. Just maintaining the current dividend implies a dividend payout ratio of  $(\text{€24 million}) / (\text{€28 million}) = 85.7\%$ , which is at the high end of the historical range. No information is provided that points to increasing the dividend.

Answer A at €2.28 ≈ €2.275 = (€28 million)(0.65)/(8 million shares) would be a possible value of the dividend under a variant of the target payout ratio policy, where target payout is the indicated average payout. Answer C at €3.19 ≈ €3.1875 = [€28 million – 0.5(€5 million)]/(8 million shares) would be a possible answer under a residual dividend policy.

## SHARE REPURCHASES

# 6

A **share repurchase** (or **buyback**) is a transaction in which a company buys back its own shares. Unlike stock dividends and stock splits, share repurchases use corporate cash. Hence, share repurchases can be viewed as an alternative to cash dividends. Shares that have been issued and subsequently repurchased are classified as **treasury shares (treasury stock)** if they may be reissued or **canceled shares** if they will be retired; in either case, they are not then considered for dividends, voting, or computing earnings per share.<sup>36</sup>

In contrast to the case of cash dividends, usage or growth in usage of share repurchases has historically required enabling regulation. In the United Kingdom, share repurchases became legal in 1981. They were never explicitly illegal in the United States,<sup>37</sup> but usage became substantial only subsequent to US Securities and Exchange Commission rule 10b–18 in 1982. (That rule protected repurchasing companies from charges of share manipulation if repurchases were conducted consistent with the terms of the rule.) Other markets in continental Europe and Asia have undertaken enabling regulation relatively recently (e.g., 1995 for Japan, 1998 for Germany and Singapore, 1999 for India and Norway, 2000 for Denmark and Sweden).<sup>38</sup> Share repurchases in many markets remain subject to more restrictions than in the United States. Restrictions include requiring shareholder approval of share repurchase programs, limiting the percent of share repurchases to a certain fraction (often 10%) of outstanding shares, allowable repurchase mechanisms, and other restrictions to protect creditors.<sup>39</sup>

Share repurchases growth can be measured in relation to cash dividends. For the United States in the early 1980s, cash dividends were approximately five times greater than the market value of share repurchases. In the late 1990s and again in the first decade of the 21st century, the value of share repurchases often exceeded the value of cash dividends in the United States.<sup>40</sup> In many other markets, use of share repurchases is becoming increasingly common.

In general, when an amount of share repurchases is authorized, the company is not strictly committed to following through with repurchasing shares. This situation contrasts with the declaration of dividends, where that action does commit the company to pay the dividends. Another contrast with cash dividends is that whereas cash dividends are distributed to shareholders proportionally to their ownership percentage, share repurchases in general do not distribute cash in such a proportionate manner. For example, if repurchases are executed by a company via buy orders in the open market, cash is effectively being received by only those shareholders with concurrent sell orders.

<sup>36</sup> Across different markets, regulations differ on the permissible treatment of shares that have been repurchased.

<sup>37</sup> See Grullon and Michaely (2002).

<sup>38</sup> Sabri (2003).

<sup>39</sup> See Vermaelen (2005).

<sup>40</sup> Brealey, Myers, and Marcus (2017).

The next section presents the means by which a company may execute a share repurchase program.

## 6.1 Share Repurchase Methods

Following are the four main ways that companies repurchase shares, listed in order of importance.

- 1 **Buy in the open market.** This method of share repurchase is the most common, with the company buying its own shares as conditions warrant in the open market. The open market share repurchase method gives the company maximum flexibility. Open market repurchases are the most flexible option for a company because there is no legal obligation to undertake or complete the repurchase program; a company may not follow through with an announced program for various reasons, such as unexpected cash needs for liquidity, acquisitions, or capital expenditures. In the United States, open market transactions do not require shareholder approval. Because shareholder approval is required in Europe, Vermaelen (2005) suggested that all companies have such authorization in place in case the opportunity to buy back undervalued shares occurs in the future.<sup>41</sup> Authorizations to repurchase stock can last for years. In many shareholders' minds, the announcement of a repurchase policy provides support for the share price. If the share repurchases are competently timed to minimize price impact and to exploit perceived undervaluation in the marketplace, this method is also relatively cost effective.
- 2 **Buy back a fixed number of shares at a fixed price.** Sometimes a company will make a **fixed price tender offer** to repurchase a specific number of shares at a fixed price that is typically at a premium to the current market price. For example, in Australia, if a stock is selling at A\$37 a share, a company might offer to buy back 5 million shares from current shareholders at A\$40. If shareholders are willing to sell more than 5 million shares, the company will typically buy back a pro rata amount from each shareholder. By setting a fixed date, such as 30 days in the future, a fixed price tender offer can be accomplished quickly.
- 3 **Dutch auction.** A Dutch auction is also a tender offer to existing shareholders, but instead of specifying a fixed price for a specific number of shares, the company stipulates a range of acceptable prices. A Dutch auction uncovers the minimum price at which the company can buy back the desired number of shares with the company paying that price to all qualifying bids. For example, if the stock price is A\$37 a share, the company would offer to buy back 5 million shares in a range of A\$38 to A\$40 a share. Each shareholder would then indicate the number of shares and the lowest price at which he or she would be willing to sell. The company would then begin to qualify bids beginning with those shareholders who submitted bids at A\$38 and continue to qualify bids at higher prices until 5 million shares had been qualified. In our example, that price might be A\$39.<sup>42</sup> Shareholders who bid between A\$38 and A\$39, inclusive, would then be paid A\$39 per share for their shares. Like Method 2, Dutch auctions can be accomplished in a short time period.<sup>43</sup>
- 4 **Repurchase by direct negotiation.** In some markets, a company may negotiate with a major shareholder to buy back its shares, often at a premium to the market price. The company may do this to keep a large block of shares from

<sup>41</sup> See Vermaelen (*Ibid.*).

<sup>42</sup> Shareholders who set an A\$39 price would be subject to a pro rata amount.

<sup>43</sup> Vermaelen (2005).

overhanging the market (and thus acting to dampen the share price). A company may try to prevent an “activist” shareholder from gaining representation on the board of directors. In some of the more infamous cases, unsuccessful takeover attempts have ended with the company buying back the would-be suitor’s shares at a premium to the market price in what is referred to as a greenmail transaction, often to the detriment of remaining shareholders.<sup>44</sup> Vermaelen (2005) reported, however, that 45% of private repurchases between 1984 and 2001 were actually made at discounts, indicating that many direct negotiation repurchases are generated by the liquidity needs of large investors who are in a weak negotiating position.

Outside the United States and Canada, almost all share repurchases occur in the open market (Method 1), and not all the methods listed may be permissible according to local regulations.<sup>45</sup>

### EXAMPLE 15

#### BCII Considers Alternative Methods of Share Repurchase

The board of directors of British Columbia Industries, Inc. (BCII) is considering a 5 million common share repurchase program. BCII has a sizable cash and marketable securities portfolio. BCII’s current stock price is C\$37. The company’s chief financial officer wants to accomplish the share repurchases in a cost-effective manner. Some board members want repurchases accomplished as quickly as possible, whereas other board members mention the importance of flexibility. Discuss the relative advantages of each of the following methods with respect to cost, flexibility, and speed:

- 1 Open market share repurchases
- 2 A fixed price tender offer
- 3 Dutch auction tender offer

#### Solution to 1:

Open market share repurchases give the company the most flexibility. BCII can time repurchases, making repurchases when the market prices its stock below its perceived intrinsic value. BCII can also change amounts repurchased or even not execute the repurchase program. Open market repurchases are typically made opportunistically, with cost a more important consideration than speed. Because open market repurchases can be conducted so as to minimize any effects on price and can be timed to exploit prices that are perceived to be below intrinsic value, this method is also relatively cost effective.

#### Solution to 2:

A fixed price tender offer can be accomplished quickly, but the company usually has to offer a premium. Obviously, this raises the cost of the buyback, but the premium may provide a positive signal to investors regarding management’s view of the value of the stock.

**44** **Greenmail** is the purchase, usually at a substantial premium over market price, of the accumulated shares of a hostile investor by a company that is targeted for takeover by that investor.

**45** See Vermaelen (2005).

**Solution to 3:**

Dutch auctions generally enable a company to do the buyback at a lower price than with a fixed price tender offer. For example, a fixed price tender offer for 5 million shares at C\$40 would cost BCII C\$200 million. If the Dutch auction were successful at C\$38, the cost would be C\$190 million, a savings of C\$10 million. Dutch auctions can be accomplished quickly, though usually not as quickly as fixed price tender offers

## 6.2 Financial Statement Effects of Repurchases

Share repurchases affect both the balance sheet and income statement. Both assets and shareholders' equity decline if the repurchase is made with surplus cash. As a result, leverage increases. Debt ratios (leverage) will increase even more if the repurchase is financed with debt.

On the income statement, fewer shares outstanding could increase earnings per share (i.e., by reducing the denominator) depending on how and at what cost the repurchase is financed. We discuss the effects on the income statement and balance sheet in the following sections.

### 6.2.1 Changes in Earnings per Share

One rationale for share repurchases often cited by corporate financial officers and some investment analysts is that reducing the number of shares outstanding can increase earnings per share (EPS). Assuming a company's net income does not change, a smaller number of shares after the buyback will produce a higher EPS. If a company's share repurchase is financed by high-cost borrowing, the resulting lower net income can offset the effect of the reduced shares outstanding, producing a lower EPS.

Examples 16 and 17 show changes in EPS resulting from alternative methods of financing a share repurchase.

#### EXAMPLE 16

### Share Repurchase Using Idle Cash

Takemiya Industries, a Japanese company, has been accumulating cash in recent years with a plan of expanding in emerging Asian markets. Takemiya's management and directors believe that such expansion is no longer practical, and they are considering a share repurchase using surplus cash. Takemiya has 10 million shares outstanding, and its net income is ¥100 million. Takemiya's share price is ¥120. Cash not needed for operations totals ¥240 million and is invested in Japanese government short-term securities that earn virtually zero interest. For a share repurchase program of the contemplated size, Takemiya's investment bankers think the stock could be bought in the open market at a ¥20 premium to the current market price, or ¥140 a share. Calculate the impact on EPS if Takemiya uses the surplus cash to repurchase shares at ¥140 per share.<sup>46</sup>

<sup>46</sup> Accounting principles in some countries require that the calculation of EPS in a given year be on the basis of the weighted average number of shares outstanding during the year. For purposes of illustration, we ignore that convention in our examples.

**Solution:**

First, note that current EPS =  $(¥100 \text{ million net income})/(10 \text{ million shares}) = ¥10.00$ . If Takemiya repurchases shares, net income is unchanged at ¥100 million. A share repurchase at ¥140 a share reduces share count by approximately 1.7 million shares ( $¥240,000,000/¥140$ ) so that 8.3 million shares remain outstanding. Thus, after the share repurchase, EPS should be  $(¥100 \text{ million})/(8.3 \text{ million shares}) = ¥12.00$ , approximately. EPS would increase by 20% as a result of the share repurchase. Note that EPS would increase even more if the open market purchases were accomplished at the prevailing market price without the premium.

In the absence of idle cash and equivalents, companies may fund share repurchases by using long-term debt. Example 17 shows that any increase in EPS is dependent on the company's after-tax borrowing rate on the funds used to repurchase stock.

**EXAMPLE 17****Share Repurchases Using Borrowed Funds**

Jensen Farms, Inc., plans to borrow US\$12 million, which it will use to repurchase shares. The following information is given:

- Share price at time of share repurchase = US\$60
- Earnings after tax = US\$6.6 million
- EPS before share repurchase = US\$3
- Price/Earnings ratio (P/E) = US\$60/US\$3 = 20
- Earnings yield (E/P) = US\$3/US\$60 = 5%<sup>47</sup>
- Shares outstanding = 2.2 million
- Planned share repurchase = 200,000 shares

- 1 Calculate the EPS after the share repurchase, assuming the after-tax cost of borrowing is 5%.
- 2 Calculate the EPS after the share repurchase, assuming the company's borrowing rate increases to 6% because of the increased financial risk of borrowing the US\$12 million.

**Solution to 1:**

$$\begin{aligned}
 \text{EPS after buyback} &= (\text{Earnings} - \text{After-tax cost of funds})/\text{Shares outstanding after buyback} \\
 &= [\text{US$6.6 million} - (\text{US$12 million} \times 0.05)]/2 \text{ million shares} \\
 &= [\text{US$6.6 million} - (\text{US$0.6 million})]/2 \text{ million shares} \\
 &= \text{US$6.0 million}/2 \text{ million shares} \\
 &= \text{US$3.00}
 \end{aligned}$$

With the after-tax cost of borrowing at 5%, the share repurchase has no effect on the company's EPS. Note that the stock's earnings yield, the ratio of earnings per share to share price or E/P, was  $\text{US$3}/\text{US$60} = 0.05$  or 5%, equal to the after-tax cost of debt.

<sup>47</sup> The E/P is the reciprocal of the price-to-earnings ratio, P/E.

**Solution to 2:**

$$\begin{aligned}
 \text{EPS after buyback} &= (\text{Earnings} - \text{After-tax cost of funds})/\text{Shares outstanding after buyback} \\
 &= [\text{US\$6.6 million} - (\text{US\$12 million} \times 0.06)]/2 \text{ million shares} \\
 &= [\text{US\$6.6 million} - (\text{US\$0.72 million})]/2 \text{ million shares} \\
 &= \text{US\$5.88 million}/2 \text{ million shares} \\
 &= \text{US\$2.94}
 \end{aligned}$$

Note that in this case, the after-tax cost of debt, 6%, is greater than the 5% earnings yield; thus, a reduction in EPS resulted.

In summary, a share repurchase may increase, decrease, or have no effect on EPS. The effect depends on whether the repurchase is financed internally or externally. In the case of internal financing, a repurchase increases EPS only if the funds used for the repurchase would *not* earn their cost of capital if retained by the company.<sup>48</sup> In the case of external financing, the effect on EPS is positive if the earnings yield exceeds the after-tax cost of financing the repurchase. In Example 17, when the after-tax borrowing rate equaled the earnings yield of 5%, EPS was unchanged as a result of the buyback. Any after-tax borrowing rate above the earnings yield would result in a decline in EPS, whereas an after-tax borrowing rate less than the earnings yield would result in an increase in EPS.

These relationships should be viewed with caution so far as any valuation implications are concerned. Notably, to infer that an increase in EPS indicates an increase in shareholders' wealth would be incorrect. For example, the same idle cash could also be distributed as a cash dividend. Informally, if one views the total return on a stock as the sum of the dividend yield and a capital gains return, any capital gains as a result of the boost to EPS from the share repurchase may be at the expense of an offsetting loss in dividend yield.

### 6.2.2 Changes in Book Value per Share

Price to book value per share is a popular ratio used in equity valuation. The following example shows the impact of a share repurchase on book value per share (BVPS).

<sup>48</sup> See Cornell (2009).

**EXAMPLE 18****The Effect of a Share Repurchase on Book Value per Share**

The market price of both Company A's and Company B's common stock is US\$20 a share, and each company has 10 million shares outstanding. Both companies have announced a US\$5 million buyback. The only difference is that Company A has a market price per share greater than its book value per share, whereas Company B has a market price per share less than its book value per share:

- Company A has a book value of equity of US\$100 million and BVPS of US\$100 million/10 million shares = US\$10. *The market price per share of US\$20 is greater than BVPS of US\$10.*
- Company B has a book value of equity of US\$300 million and BVPS of US\$300 million/10 million shares = US\$30. *The market price per share of US\$20 is less than BVPS of US\$30.*

Both companies:

- buy back 250,000 shares at the market price per share (US\$5 million buy-back/US\$20 per share = 250,000 shares) and
- are left with 9.75 million shares outstanding (10 million pre-buyback shares – 0.25 million repurchased shares = 9.75 million shares).

After the share repurchase:

- Company A's shareholders' equity at book value falls to US\$95 million (US\$100 million – US\$5 million), and its *book value per share decreases* from US\$10 to US\$9.74 (shareholders' equity/shares outstanding = US\$95 million/9.75 million shares = US\$9.74).
- Company B's shareholders' equity at book value falls to US\$295 million (US\$300 million – US\$5 million), and its *book value per share increases* from US\$30 to US\$30.26 (shareholders' equity/shares outstanding = US\$295 million/9.75 million = US\$30.26).

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This example shows that when the market price per share is greater than its book value per share, BVPS will decrease after the share repurchase. When the market price per share is less than BVPS, however, BVPS will increase after a share repurchase.

### **6.3 Valuation Equivalence of Cash Dividends and Share Repurchases: The Baseline**

A share repurchase should be viewed as equivalent to the payment of cash dividends of equal amount in terms of the effect on shareholders' wealth, all other things being equal. "All other things being equal" in this context is shorthand for assumptions that the taxation and information content of cash dividends and share repurchases do not differ. Understanding this baseline equivalence result permits more advanced analysis for when taxation and/or information content do differ between cash dividends and share repurchases. Example 19 demonstrates the claim of equivalence in the "all other things being equal" case.

**EXAMPLE 19**

## The Equivalence of Share Repurchases and Cash Dividends

Waynesboro Chemical Industries, Inc. (WCII) has 10 million shares outstanding with a current market value of \$20 per share. WCII's board of directors is considering two ways of distributing WCII's current \$50 million free cash flow to equity. The first method involves paying an irregular or special cash dividend of  $\$50\text{ million}/10\text{ million} = \$5$  per share. The second method involves repurchasing \$50 million worth of shares. For simplicity, we make the assumptions that dividends are received when the shares go ex-dividend and that any quantity of shares can be bought at the market price of \$20 per share. We also assume that the taxation and information content of cash dividends and share repurchases, if any, do not differ. How would the wealth of a shareholder be affected by WCII's choice of method in distributing the \$50 million?

### **Solution:**

#### **Cash Dividend**

After the shares go ex-dividend, a shareholder of a single share would have \$5 in cash (the dividend) and a share worth  $\$20 - \$5 = \$15$ . The ex-dividend value of \$15 can be demonstrated as the market value of equity after the distribution of \$50 million divided by the (unchanged) number of shares outstanding after the dividend payment, or  $[(10\text{ million})(\$20) - \$50\text{ million}]/10\text{ million} = \$150\text{ million}/10\text{ million} = \$15$ . Total wealth from ownership of one share is, therefore,  $\$5 + \$15 = \$20$ .

#### **Share Repurchase**

With \$50 million, WCII could repurchase  $\$50\text{ million}/\$20 = 2.5$  million shares. The post-repurchase share price would be unchanged at \$20, which can be calculated as the market value of equity after the \$50 million share repurchase divided by the shares outstanding after the share repurchase, or  $[(10\text{ million})(\$20) - \$50\text{ million}]/(10\text{ million} - 2.5\text{ million}) = \$150\text{ million}/7.5\text{ million} = \$20$ . Total wealth from ownership of one share is, therefore, \$20 —exactly the same as in the case of a cash dividend. Whether the shareholder actually sold the share back to WCII in the share repurchase is irrelevant for a shareholder's wealth: If the share was sold, \$20 in cash would be realized; if the share was not sold, its market value of \$20 would count equally toward the shareholder's wealth.

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The theme of Example 19 is that a company should not expect to create or destroy shareholder wealth merely by its method of distributing money to shareholders (i.e., by share repurchases as opposed to cash dividends).<sup>49</sup> Example 20 illustrates that if a company repurchases shares from an individual shareholder at a negotiated price representing a premium over the market price, the remaining shareholders' wealth is reduced.

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**49** Oded and Michel (2008) lend support to the argument of value neutrality. Using a simulation, as well as the example of ExxonMobil, they find that no difference exists in shareholder wealth over a period of years, regardless of whether a company used its cash to repurchase shares, pay dividends, or hoard the cash.

**EXAMPLE 20****Direct Negotiation: A Share Repurchase That Transfers Wealth**

Florida Citrus (FC) common shares sell at US\$20, and there are 10 million shares outstanding. Management becomes aware that Kirk Parent recently purchased a major position in its outstanding shares with the intention of influencing the business operations of FC in ways the current board does not approve. An adviser to the board has suggested approaching Parent privately with an offer to buy back US\$50 million worth of shares from him at US\$25 per share, which is a US\$5 premium over the current market price. The board of FC declines to do so because of the effect of such a repurchase on FC's other shareholders. Determine the effect of the proposed share repurchase on the wealth of shareholders other than Parent.

**Solution:**

With US\$50 million, FC could repurchase  $\frac{\text{US\$50 million}}{\text{US\$25}} = 2 \text{ million shares}$  from Parent. The post-repurchase share price would be US\$18.75, which can be calculated as the market value of equity after the US\$50 million share repurchase divided by the shares outstanding after the share repurchase, or  $\frac{[(10 \text{ million})(\text{US\$20}) - \text{US\$50 million}]}{(10 \text{ million} - 2 \text{ million})} = \text{US\$150 million}/8 \text{ million} = \text{US\$18.75}$ . Shareholders other than Parent would lose  $\text{US\$20} - \text{US\$18.75} = \text{US\$1.25}$  for each share owned. Although this share repurchase would conserve total wealth (including Parent's), it effectively transfers wealth to Parent from the other shareholders.

## 6.4 The Dividend versus Share Repurchase Decision

The question of the valuation implications of share repurchases and dividends is of great interest to investors. Many investors and corporate managers believe that share repurchases have, on average, a net positive effect on shareholder value. Vermaelen (2005) reviewed major studies and found that share repurchase announcements are accompanied by significant positive excess returns both around the announcement date and for the next two years—and in some studies, five years. An explanation consistent with that finding is that managements tend to buy back their stock when it is undervalued in the marketplace and issue stock when it is overvalued.

Theory concerning the dividend–share repurchase decision generally concludes that share repurchases are equivalent to cash dividends of equal amount in their effect on shareholders' wealth, all other things being equal. Further discussion about the choice revolves around what might not "be equal" and what might cause one distribution mechanism to be preferred over the other. The use of share repurchases also may be legally restricted.<sup>50</sup>

In general, share repurchases can be considered part of a company's broad policy on distributing earnings to shareholders and a company may engage in share repurchases for reasons similar to those mentioned in connection with cash dividends—for example, to distribute free cash flow to equity to common shareholders. A number of additional reasons for share repurchases have been brought forward in one survey of US chief financial officers, including the following:<sup>51</sup>

- Potential tax advantages

<sup>50</sup> See Vermaelen (2005) for details.

<sup>51</sup> See Brav, Graham, Harvey, and Michaely (2005).

- Share price support/signaling that the company considers its shares a good investment
- Added managerial flexibility
- Offsetting dilution from employee stock options
- Increasing financial leverage

In jurisdictions that tax shareholder dividends at higher rates than capital gains, share repurchases have a tax advantage over cash dividends. Even if the two tax rates are equal, the option to defer capital gains taxes—by deciding not to participate in the share repurchase—will be valuable to many investors.

Management of a company may view its own shares as undervalued in the marketplace and hence a good investment. Although management's stock market judgment can be just as good or bad as that of any other market participant, corporate management typically does have more information about the company's operation and future prospects than does any outside investor or analyst. Furthermore, share repurchases via open market purchase, the dominant repurchase mechanism, allow management to time share repurchases with respect to market price. The announcement of a share repurchase program is often understood as a positive signal about the company's prospects and attractiveness as an investment. An unexpected announcement of a meaningful share repurchase program can often have the same positive impact on share price as would a better-than-expected earnings report or similar positive event. In the days following the global stock market crash of October 1987, a number of prominent companies announced huge buybacks in an effort to halt the slide in the price of their shares and show confidence in the future. It may have been an important aspect in the stock market recovery that followed. Some investment analysts, however, take issue with the notion that initiation of share repurchases is a positive signal, because a repurchase program could mean that the company has no new profitable investment opportunities and is thus returning cash to shareholders.

Unlike regular cash dividends, share repurchase programs appear not to create the expectation among investors of continuance in the future. Furthermore, in contrast to an announced dividend, the announcement of a share repurchase by open market purchase does not typically create an obligation to follow through with repurchases. Additionally, the timing of share repurchases via open market activity is at managers' discretion. Share repurchases also afford shareholders flexibility because participation is optional, which is not the case with the receipt of cash dividends.

For some companies, share repurchases are used to offset the possible dilution of earnings per share that may result from the exercise of employee stock options. Whether stated or not, many companies try to repurchase at least as many shares as were issued in the exercise of stock options—even though the options are typically exercised at lower prices than the repurchase price.

Another reason for repurchasing shares is to modify the company's capital structure because share repurchases can be used to increase leverage. Share buybacks funded by newly issued debt increase leverage more than those funded by surplus cash.

Among other reasons mentioned for share repurchases by corporate managers is the objective of increasing EPS. This objective, however, is problematic for two reasons. First, even when share repurchases result in an EPS increase, the required rate of return will likely increase, reflecting higher leverage. Second, according to finance theory, changing EPS by changing the number of shares outstanding does not affect shareholder wealth given that total free cash flow is unchanged.

**EXAMPLE 21****Share Repurchase to Increase Financial Leverage**

Canadian Holdings Inc. (CHI), with debt and a debt ratio of C\$30 million and 30%, respectively, plans a share repurchase program involving C\$7 million or 10% of the market value of its common shares.

- 1 Assuming nothing else changes, what debt ratio would result from financing the repurchases using cash on hand?
- 2 Assuming nothing else changes, what debt ratio would result from financing the repurchases using new debt?
- 3 Discuss the effect on value of equity from financing the repurchases using cash on hand, assuming CHI's net income and P/E remain the same.
- 4 Discuss the effect on value of equity from financing the repurchases using new debt, assuming CHI's after-tax cost of debt is greater than its E/P, which remains the same.
- 5 Discuss the effect on value of debt from financing the repurchases using new debt, assuming the conditions in question 4 (above) and knowing that CHI is in imminent danger of a credit rating downgrade.

**Solution to 1:**

Assuming nothing else changes, if CHI uses cash on hand to make the share repurchase, the debt ratio would increase to 32% ( $C\$30 \text{ million}/C\$93 \text{ million} = 0.3226$  or 32.3%).

**Solution to 2:**

Assuming nothing else changes, if CHI uses debt to finance the share repurchase, the debt ratio would increase to 37% ( $C\$37 \text{ million}/C\$100 \text{ million} = 0.3700$  or 37.0%).

**Solution to 3:**

After repurchase, CHI's equity stands at C\$63 mil. However, with the same net income and fewer shares outstanding, its EPS would increase. Then, with the same P/E, CHI's market value of equity would be expected to increase above C\$63 mil.

**Solution to 4:**

After repurchase, CHI's equity stands at C\$63 mil. However, with the after-tax cost of debt exceeding the E/P, its EPS would decrease. Then, with the same P/E, CHI's market value of equity would be expected to decrease below C\$63 mil.

**Solution to 5:**

After repurchase, CHI's debt stands at C\$37 mil. However, with the real threat of a credit rating downgrade, spreads for CHI's debt versus Canadian treasuries would widen. Then, CHI's market value of debt would be expected to decrease below C\$37 mil.

Note that with the assumptions in questions 4 and 5, the post-repurchase market values of both equity and debt would be expected to decrease. Therefore, the proportion of each in CHI's post-repurchase capital structure is indeterminate based on the information given.

Exhibit 11 shows the results. By either means of financing the share repurchase, financial leverage increases.<sup>52</sup>

**Exhibit 11 Estimated Impact on Capital Structure (C\$ millions)**

	After Buyback					
	Before Buyback		All Cash		All Debt	
	C\$	%	C\$	%	C\$	%
Debt	30	30	30	32	37	37
Equity (at market)	70	70	63	68	63	63
Total Cap	100	100	93	100	100	100

Canadian Holdings' beginning debt ratio was 30%. If Canadian Holdings uses borrowed funds to repurchase equity, the debt ratio at market value will increase to 37%, which is significantly more than if it used excess cash (32%).

### EXAMPLE 22

#### Siemens AG Announces Share Buyback to Achieve Target Capital Structure

In November 2007 Siemens AG, a world leader in electrical and electronic equipment, reported that in order to optimize its capital structure it would repurchase shares by fiscal year end 2010 to achieve a target ratio of net industrial debt to EBITDA in the range 0.8x – 1.0x. Accordingly, Siemens said it could repurchase shares in the amount up to €10 billion in several tranches. Siemens repurchases in the first two tranches were as shown in Exhibit 12.

**Exhibit 12 Share Buyback Activities, First Tranche (2008)**

Month	Shares Repurchased	Average Price (€)	Total Value (€)
January	1,829,000	84.6186	154,767,465
February	9,579,498	88.2335	845,232,490
March	9,943,030	75.4019	749,723,179
April	3,503,013	71.4466	250,278,202
<b>Sum</b>	<b>24,854,541</b>	<b>79.9252</b>	<b>2,000,001,336</b>

<sup>52</sup> Note that using a ratio of net debt to capital based on net debt (defined as debt net of cash) and capital (defined as net debt plus equity), the effect of using cash or using debt in the share repurchase would be the same. The initial ratio of net debt to capital is  $(30 - 7)/(23 + 70) = 25\%$ . Using cash for the share repurchase, this ratio would become  $(30)/(30 + 63) = 32\%$ , and using debt in the transaction, it would also be  $(37 - 7)/(30 + 63) = 32\%$ .

**Exhibit 12 (Continued)**

<b>Share Buyback Activities, Second Tranche (2008)</b>			
<b>Month</b>	<b>Shares Repurchased</b>	<b>Average Price (€)</b>	<b>Total Value (€)</b>
June	13,709,495	72.8857	999,225,911
July	14,207,169	70.3870	999,999,975
<b>Sum</b>	<b>27,916,664</b>	<b>71.6364</b>	<b>1,999,225,886</b>

*Source:* Siemens AG website, accessed November 2007.

The company bought back about 52.77 million shares for approximately €4 billion. No further repurchases were announced, and it is possible that Siemens shelved the program to conserve cash in the economic downturn.

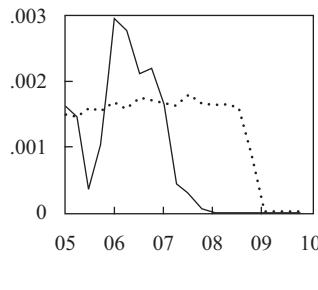
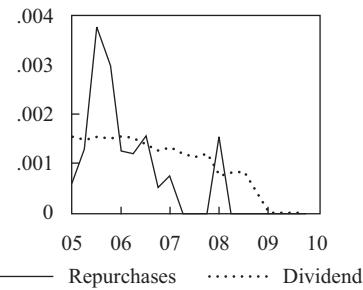
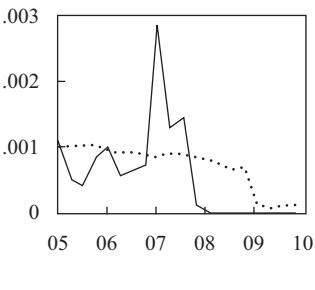
A company can use both special cash dividends and share repurchases as a supplement to regular cash dividends. These means of distributing cash are often used in years when there are large and extraordinary increases in cash flow that are not expected to continue in future years. In making these types of payments, the company essentially communicates that the distribution, like the increase in cash flow, should not be expected to continue in the future. In this context, a share repurchase is effectively an alternative to paying a special cash dividend.

Some companies initiate payouts to shareholders using share repurchases rather than cash dividends.<sup>53</sup> As with the case of a share repurchase substituting for a special cash dividend, the use of share repurchases is again with the expectation that it will not be viewed as creating a fixed commitment.

Although all of the preceding can be the stated or unstated reasons for share repurchases, in general, share repurchases increase in volume when the economy is strong and companies have more cash. During recessions, when cash is often short, share repurchases typically fall. From the fourth quarter of 2004 to the fourth quarter of 2008, the 500 companies in the S&P 500 spent US\$1.8 trillion on share repurchases as compared with \$2 trillion on capital expenditures and \$1 trillion on cash dividends. In the market crash of 2008–2009, share repurchases plummeted.<sup>54</sup> Major companies (particularly in the global financial sector) that had made large share repurchases encountered challenges to their financial viability in 2008 and 2009. This caused them to abandon their share repurchases and then to drastically curtail, or even eliminate, their dividends, as shown in Exhibit 13 for several large US banks.

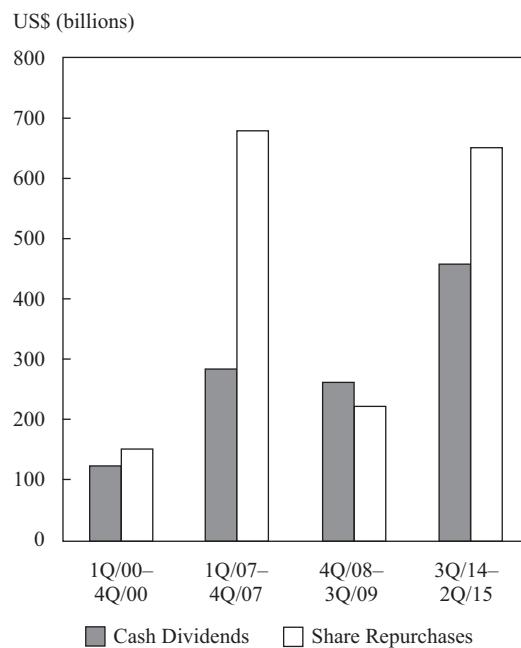
<sup>53</sup> Grullon and Michaely (2002).

<sup>54</sup> Grace and Curran (2009).

**Exhibit 13 Share Repurchases and Dividends for Several Large US Banks****A. Bank of America Corporation****B. Citigroup Inc.****C. JP Morgan Chase and Co.**

Source: Hirtle (2016), “Bank Holding Company Dividends and Repurchases during the Financial Crisis” (Federal Reserve Bank of New York, March 2014, revised April 2016).

As can be seen in Exhibit 14, data for the companies in the Russell 1000 Index, a broader US stock index than the S&P 500, show that share repurchases grew at almost twice the rate of cash dividends between 2000 and 2007, 25.0% compared to 13.0%. However, during the financial crisis of 2008–2009, companies cut back sharply on their discretionary share repurchases, from US\$680 billion to US\$223 billion, because many faced shrinking operating cash flows or even financial distress. Although cash dividends were also cut, the decline was much less considerable (US\$286 billion to US\$262 billion). By 2015 corporate operating cash flows had recovered to the point where total distributions (cash dividends plus share repurchases) reached US\$1,102 billion, surpassing their previous peak of US\$966 billion in 2007. Share repurchases increased nearly three times from their 2009 levels to reach US\$650 billion. However, cash dividends reached US\$452 billion, or over 40% of total distributions; this compares to slightly less than 30% of total distributions (US\$286 billion/US\$966 billion) in 2007. The higher proportion of dividends in total distributions may reflect investors' increased appetite for dividend yield during the extended period of low (or even negative) interest rates on many fixed-income securities that has prevailed in many developed countries since the end of the financial crisis.

**Exhibit 14 Share Repurchases and Cash Dividends: Russell 1000 Companies (2000 to 2015)**


Time Period	Cash Dividends*	Share Repurchases	CAGR Cash Dividends	CAGR Repurchases
	(US\$ billions)		(Base Year is 2000)	
1Q2000–4Q2000	126	152	—	—
1Q2007–4Q2007	286	680	13.0%	25.0%
4Q2008–3Q2009	262	223	9.0%	4.0%
3Q2014–2Q2015	452	650	10.0%	11.0%

\* Includes Special Dividends

Source: JP Morgan, "2015 Distribution Policy" (September 2015).

Example 23, in which a company's board of directors initiates a cash dividend, integrates a number of themes related to cash dividends, stock dividends (in which additional shares are distributed to shareholders instead of cash), and share repurchases.

**EXAMPLE 23**
**Scottsville Instruments' Dividend Policy Decision**

Scottsville Instruments, Inc., (SCII) is a US-based company emerging as a leader in providing medical testing equipment to the pharmaceutical and biotechnology industries. SCII's primary markets are growing, and the company is spending US\$100 million a year on research and development to enhance its competitive position. SCII is highly profitable and has substantial positive free cash flow after funding positive NPV projects. During the past three years, SCII has made significant share repurchases. Subsequent to the reduction in the tax rate on cash dividends to 15% in the United States, the same tax rate as that on long-term capital gains, SCII management is proposing the initiation of a cash dividend. The first dividend is proposed to be an annual dividend of US\$0.40

a share to be paid during the next fiscal year. Based on estimated earnings per share of US\$3.20, this dividend would represent a payout ratio (DPS/EPS) of 0.125 or 12.5%. The proposal that will be brought before the board of directors is the following:

“Proposed: Scottsville Instruments, Inc., will institute a program of cash dividends. The first dividend will be an annual dividend of US\$0.40 a share, to be paid at a time to be determined during the next fiscal year. Thereafter, an annual dividend will be paid consistent with retaining funds sufficient to finance profitable capital projects.”

The company’s board of directors will formally consider the dividend proposal at its next meeting in one month’s time. Although some directors favor the dividend initiation proposal, other directors, led by William Marshall, are skeptical of it. Marshall has stated:

“The initiation of a cash dividend will suggest to investors that SCII is no longer a growth company.”

As a counterproposal, Marshall has offered his support for the initiation of an annual 2% stock dividend. Elise Tashman, a director who is neutral to both the cash dividends and stock dividend ideas, has told Marshall the following:

“A 2% stock dividend will not affect the wealth of our shareholders.”

Exhibit 15 presents selected *pro forma* financials of SCII, if the directors approve the initiation of a cash dividend.

**Exhibit 15 Scottsville Instruments Pro Forma Financial Data Assuming Cash Dividend (US\$ millions)**

<b>Income Statement</b>		<b>Statement of Cash Flows</b>	
Sales	1,200	Cash flow from operations	135
Earnings before taxes	155	Cash flow from investing activities	(84)
Taxes	35	Cash flow from financing activities:	
Net income	120	Debt repayment	(4)
		Share repurchase	(32)
		Proposed dividend	(15)
		Estimated change in cash	0
<b>Ratios</b>		<b>Five-Year Forecasts</b>	
Current ratio	2.1	Sales growth	8% annually
Debt/Equity (at market)	0.27	Earnings growth	11% annually
Interest coverage	10.8x	Projected cost of capital	10%
ROA	10.0%		
ROE	19.3%		
P/E	20x		
E/P	5.0%		

Using the information provided, address the following:

- 1 Critique Marshall's statement.
- 2 Justify Tashman's statement.
- 3 Identify and explain the dividend policy that the proposed US\$0.40 a share cash dividend reflects.

#### **Solution to 1:**

The following points argue against the thesis of Marshall's statement:

- As discussed in the text, dividend initiations and increases are on average associated with higher future earnings growth.
- Forecasted sales and earnings growth rates are relatively high.
- SCII still has considerable positive NPV projects available to it, as shown by the cash flow from investing activities of negative US\$84 million. This fact is consistent with SCII being a company with substantial current growth opportunities.
- For the past three years SCII has been making share repurchases, so investors are already cognizant that management is distributing cash to shareholders. The initiation of a dividend as a continuation of that policy is less likely to be interpreted as an information signaling event.

#### **Solution to 2:**

A stock dividend has no effect on shareholder wealth. A shareholder owns the same percentage of the company and its earnings as it did before the stock dividend. All other things being equal, the price of a stock will decline to reflect the stock dividend, but the decline will be exactly offset by the greater number of shares owned.

#### **Solution to 3:**

As shown in the statement of cash flows, the US\$0.40 a share annual dividend reflects a total amount of US\$15 million, fully using SCII's free cash flow after acceptance of positive NPV projects. The proposal brought before the board does not suggest a commitment to maintain the annual dividend at US\$0.40 a share (or greater), as a stable dividend policy would typically imply. Rather, the funding of profitable capital projects will first be considered. These facts taken together are most consistent with a residual dividend policy.

## **GLOBAL TRENDS IN PAYOUT POLICY**

**7**

An interesting question is whether corporations are changing their dividend policies in response to changes in the economic environment and in investor preferences. In 2001, Fama and French<sup>55</sup> investigated the case of disappearing dividends in the United States. They found a large decline in the number of US-based industrial companies that paid dividends from 1978 to 1998. But the aggregate payout ratio in the 1990s was about 40%, within the 40–60% range typical of the 1960–1998 period. Fama and French argued that the decline in dividends was related to the large number of relatively unprofitable companies that were assuming prominence in the stock

<sup>55</sup> Fama and French (2001).

market. DeAngelo, DeAngelo, and Skinner<sup>56</sup> extended Fama and French's argument by showing that even though fewer corporations were paying dividends, the largest 100 companies in the United States increased their inflation-adjusted dividends by 23% from 1978 to 2000. What appeared to be happening was the formation of two tiers of companies. The first tier is composed of approximately 100 large, extremely profitable companies that have a fairly stable payout ratio of around 42%. The second tier is composed of two types of non-dividend payers: financially troubled, marginally profitable or money-losing companies, and/or companies related to technology that typically use share repurchase as a substitute for dividends.

Dividend policy practices have international differences and change through time, even in one market, consistent with the catering theory of Baker and Wurgler (2004), which predicts that companies adapt their dividend policy over time to changing investor tastes.<sup>57</sup> Typically, fewer companies in a given US stock market index have paid dividends than have companies in a comparable European stock market index. In addition, the following broad trends in dividend policy have been observed:

- The fraction of companies paying cash dividends has been in long-term decline in most developed markets (e.g., the United States, Canada, the European Union overall, the United Kingdom, and Japan).<sup>58</sup>
- Since the early 1980s in the United States<sup>59</sup> and the early 1990s in the United Kingdom and continental Europe,<sup>60</sup> the fraction of companies engaging in share repurchases has trended upward.

Ferris, Sen, and Unlu (2009)<sup>61</sup> study dividend behavior across 25 countries and conclude that both aggregate dividend amounts as well as payout ratios have generally increased over time, although the fraction of dividend payers has decreased. More recent studies by Bildik, Fatemi, and Fooladi (2015) and Fatemi and Bildik (2012) use data from 33 countries, including the United States, to substantiate the proportion of cash dividend paying firms declining over time, with aggregate dividend payments concentrated in a relatively small number of firms.<sup>62</sup> The dividend payers are, on average, larger, more profitable, have fewer growth opportunities, and spend less on R&D compared to the non-dividend payers. These results support the international extension of the two-tier framework mentioned previously for the United States.

Moreover, Hail, Tahoun, and Wang (2014) document internationally a negative relationship between dividend initiations/increases and enhanced corporate governance and transparency (such as mandatory adoption of IFRS rules and enforcement of new insider trading laws). This is consistent with the notion of the decreasing information content of dividends and their reduced signaling role as governance and transparency of markets improves. Similarly, Jain and Chu (2014) find less generous dividend payout policies in countries requiring detailed corporate disclosures and having strong investor protection. The reduction in both information asymmetry and agency issues resulting from improved corporate governance, along with the flexibility offered by share repurchases, appear to explain the long-term decline in dividend payers.

**56** DeAngelo, DeAngelo, and Skinner (2004).

**57** For the international evidence of catering and of international differences, see Ferris, Jayaraman, and Sabherwal (2009).

**58** See Von Eije and Megginson (2008) and references therein.

**59** Important in the United States was the adoption of Securities and Exchange Commission Rule 10b-18 in 1982, which relieved companies from concerns of stock manipulation in repurchasing shares as long as companies follow certain guidelines.

**60** See Von Eije and Megginson (2008).

**61** Ferris, Sen, and Unlu (2009).

**62** Bildik et al. (2015) pointed to some reversal in the long-term downtrend in the fraction of dividend payers and in payout ratios for US and foreign companies subsequent to the global financial crisis.

## ANALYSIS OF DIVIDEND SAFETY

8

The global recession that began in late 2007 gave rise to the largest number of dividend cuts and suspensions since the Great Depression of the 1930s.<sup>63</sup> Global titans—such as GE, Toyota, Barclays, UBS, and Daimler AG—cut their dividends. By mid-2009, S&P 500 dividends for US companies were down by 25% from the prior year, and, as indicated earlier in Exhibit 15, by 3Q 2009 dividends for companies in the broader Russell 1000 index declined by over 8% from 2007 levels. In this section, we discuss how an analyst can form a judgment on the likelihood that a company's cash dividend may be cut.

The traditional way of looking at dividend safety is the dividend payout ratio (dividends/net income) and its inverse, the **dividend coverage ratio** (net income/dividends). A higher dividend payout ratio or a lower dividend coverage ratio tends to indicate, all else equal, higher risk of a dividend cut. The logic is that with a relatively high dividend payout ratio, a relatively small percentage decline in earnings could cause the dividend not to be payable out of earnings.

### EXAMPLE 24

#### Traditional Measures of Dividend Safety

Given the following data, calculate the dividend payout and coverage ratios:

Mature European SA	2016 FY
Net income available for common stock	EUR 100 mil.
Dividends paid	EUR 40 mil.

#### Solution:

Dividend payout ratio	$40/100 = 40\%$
Dividend coverage ratio	$100/40 = 2.5x$

In judging these ratios, various generalizations may be stated based on observed practice. In stating these generalizations, we emphasize that they should be confirmed for the particular market and time period being addressed.

Small, young companies generally do not pay dividends, preferring to reinvest internally for growth. However, as such companies grow, they typically initiate dividends and their payout ratios tend to increase over time. Large mature companies often target dividend payout ratios of 40% to 60%, so that dividend coverage ratios range from about 1.7x to 2.5x, excluding "extra" payments. Mature companies are expected to be in this range over the course of a 5- to 10-year business cycle. Higher dividend payout ratios (or lower dividend coverage ratios) often constitute a risk factor that a dividend may be cut if earnings decline. High dividend payout ratios in relation to those of peer group companies may also point to dividend safety concerns. When a dividend coverage ratio drops to 1.0, the dividend is considered to be in jeopardy unless non-recurring events, such as an employee strike or a typhoon, are responsible for a temporary decline in earnings. In judging safety, qualitative pluses are awarded for companies that have had stable or increasing dividends, while minuses accrue to

<sup>63</sup> *The Economist* (7 March 2009, p. 77).

companies that have reduced their dividend in the past. Indeed, concerning this issue, the 1962 edition of Graham, et al., stated that “[t]he absence of rate reduction in the past record is perhaps as important as the presence of numerous rate advances.”<sup>64</sup>

Free cash flow to equity, defined earlier, represents the cash flow available for distribution as dividends after taking account of working and fixed capital expenditure needs. If those needs are ignored, distribution of dividends may be at cross-purposes with shareholder wealth maximization. Cash flow (specifically free cash flow to equity), not reported net income, should be viewed as the source of cash dividend payments from that perspective. Thus, analysis of dividend safety can properly include payout and coverage ratios based on FCFE rather than net income. Other cash flow definitions besides FCFE have also been used in such ratios. Examining the correlation of dividends with cash flow measures may also provide insights.

**Payouts** should be considered in terms of share repurchases as well as dividends because they both represent cash distributions to shareholders. Arguably, a comprehensive measure of dividend safety would relate FCFE to both cash dividends and share repurchases:<sup>65</sup>

$$\text{FCFE coverage ratio} = \text{FCFE}/[\text{Dividends} + \text{Share repurchases}]$$

If that ratio is 1, the company is returning all available cash to shareholders. If it is significantly greater than 1, the company is improving liquidity by using funds to increase cash and/or marketable securities. A ratio significantly less than 1 is not sustainable because the company is paying out more than it can afford by drawing down existing cash/marketable securities, thereby decreasing liquidity. At some point the company will have to raise new equity or cut back on capital spending.

Fundamental risk factors with regard to dividend safety include above-average financial leverage. Additional issuance of debt, whether to fund projects or to finance the dividend, may be restricted during business downturns.

Example 25 shows an analysis of the sustainability of the dividend of Potash Corporation of Saskatchewan Inc. (Potash), one of the world's largest producers of fertilizer products. The analysis includes the traditional earnings/dividend coverage approach and an alternative FCFE approach that considers total cash payouts to shareholders—dividends and share repurchases.

### EXAMPLE 25

#### Potash's Coverage Ratios

Potash produces fertilizer and agricultural chemicals from its operations in Canada, the United States, South America, and the Middle East, which it sells globally. The company has paid dividends since 1990. Exhibit 16 shows financial information for the company.

#### Exhibit 16 Potash Corp.

Years Ending 31 December (US\$ millions)	2012	2013	2014	2015
Net income (earnings)	2,079	1,785	1,536	1,270
Cash flow from operations	3,225	3,212	2,614	2,338
FCInv (capital expenditures)	2,133	1,624	1,138	1,217

<sup>64</sup> Graham, Dodd, Cottle, and Tatham (1962).

<sup>65</sup> See Damodaran (2001). Damodaran actually shows the inverse, the FCFE payout ratio.

**Exhibit 16 (Continued)**

<b>Years Ending 31 December (US\$ millions)</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
Net borrowing	(462)	(153)	303	(27)
Dividends paid	467	997	1,141	1,204
Stock repurchases	0	411	1,065	0

Source: Potash Corporation Annual Reports.

- 1 Using the above information, calculate the following for 2012, 2013, 2014, and 2015:
  - A Dividend/earnings payout ratio
  - B Earnings/dividend coverage ratio
  - C Free cash flow to equity (FCFE)
  - D FCFE/[dividend + stock repurchase] coverage ratio
- 2 Discuss the trends in earnings/dividend coverage and in FCFE/[dividend + stock repurchase] coverage.
- 3 Comment on the sustainability of Potash's dividend and stocks repurchase policy after 2014/2015.

**Solution to 1:**

- A Dividend/earnings payout = US\$467/US\$2,079 = 0.225 or 22.5% in 2012, US\$997/US\$1,785 = 0.559 or 55.9% in 2013, 0.743 or 74.3% in 2014, and 0.948 or 94.8% in 2015.
- B Earnings/dividend coverage = US\$2,079/US\$467 = 4.45x in 2012, US\$1,785/US\$997 = 1.79x in 2013, 1.35x in 2014, and 1.05x in 2015.
- C FCFE = Cash flow from operations (CFO) – FCInv + Net borrowing = US\$3,225 – US\$2,133 + (US\$462) = US\$630 in 2012, US\$3,212 – US\$1,624 + (US\$153) = US\$1,435 in 2013, US\$1,779 in 2014, and US\$1,094 in 2015.
- D FCFE coverage of dividends + share repurchases = FCFE/[dividends + stock repurchases] = US\$630/(US\$467 + 0) = 1.35x in 2012 and US\$1,435/(US\$997 + US\$411) = 1.02x in 2013. Similar calculations result in 0.81x in 2014 and 0.91x in 2015.

These results are summarized in Exhibit 17.

**Exhibit 17 Potash Corp. Coverage Ratios**

<b>Years Ending 31 December</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
A. Dividend/earnings payout ratio	22.5%	55.9%	74.3%	94.8%
B. Earnings/dividend coverage ratio (x)	4.45	1.79	1.35	1.05
C. Free cash flow to equity (FCFE) (mil.)	630	1,435	1,779	1,094
D. FCFE/[div. + stock repurch.] cover. (x)	1.35	1.02	0.81	0.91

**Solution to 2:**

Although earnings/dividend coverage was nearly 4.5x in 2012, it declined steadily over the four years. By 2015, accounting earnings were just sufficient to pay the dividend (1.05x earnings-to-dividend coverage ratio). An analyst who looked at this metric should have suspected problems.

The FCFE coverage ratio was 1.35x in 2012, a year before the stock repurchase program began. In 2013 the FCFE coverage of dividends and stock repurchases declined to 1.02x. Lower capital expenditures were offset by increased dividends and the new stock repurchase program. Despite declining capital expenditures and positive net borrowings, the FCFE coverage ratio continued to fall substantially to 0.81x in 2014 as the company elected to increase distributions to shareholders. Despite completing the stock repurchase program the previous year, by 2015 FCFE had deteriorated so much that FCFE coverage of dividends was still less than 1.0x (0.91x).

**Solution to 3:**

With FCFE coverage ratio falling to 0.81x in 2014, management likely realized that it was not prudent to undertake any new discretionary stock repurchases. By 2015 net income was still declining and FCFE coverage of the dividend at less than 1.0x meant that management should probably consider cutting the dividend.

**Update:**

In January 2016 Potash announced the first ever cut in its quarterly dividend to US\$0.25 a share, a decline of 34% from its old rate of US\$0.38. Then, in July 2016 the quarterly dividend was cut again, this time to US\$0.10 a share. No new share repurchases have been announced.

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The deterioration over time of Potash's earnings/dividend coverage and FCFE coverage (of dividends and stock repurchases) was clear. There may be other instances when the earnings-to-dividend coverage ratio declines but still appears healthy. This is why it is important for analysts to closely examine the level and trend of the FCFE coverage ratio and the components of FCFE. Analysts should be particularly alert to companies that support their dividends and stock repurchases by reducing productive capital spending or by adding net debt or by some combination of the two because these are not sustainable policies.

Whether based on a company's net income or free cash flow, past financial data do not always predict dividend safety. Surprise factors and other unexpected events can confound the most rigorous analysis of past data. Equity and debt markets were shaken in 2008–2009 by the losses taken by almost all US and European banks. These losses led to the cutting and, in some cases, virtual elimination of cash dividends. Not all 21st century investors would agree with Graham and Dodd's 1962 assertion that "For the vast majority of common stocks, the dividend record and prospects have always been the most important factor controlling investment quality and value."<sup>66</sup> But most investors would agree that when the market even begins to suspect a decrease or suspension of a company's cash dividend, that expectation is likely to weigh unfavorably on that company's common stock valuation. Therefore, many analysts look for external stock market indicators of market expectations of dividend cuts.

Extremely high dividend yields compared with a company's past record and current bond yields is often another warning signal that investors are predicting a dividend cut. For example, the dividend yield on General Electric shares just prior to its 68%

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<sup>66</sup> Graham, Dodd, Cottle, and Tatham (1962).

dividend cut in 2008 was nearly 14%.<sup>67</sup> After the dividend cut, GE shares still yielded about 4.7%, relatively high compared with its yields in recent years (generally under 3%) and the then current 10-year T-bond yield of about 3%. In such cases, investors bid down the price of shares such that, after the expected cut, the expected total return on the shares was still adequate.

The observations of Madden (2008) support an attitude of caution with respect to very high dividend yields. Madden examined yields for the 1,963 stocks in the MSCI World Index.<sup>68</sup> His company classified 865 companies out of the 1,963 companies as a “High Dividend Universe” (HDU). In the early months of the economic decline, Madden found that 78.6% of the companies in the HDU had questionable ability to maintain their dividend payments as compared with 30.7% of all the companies in the MSCI World Index. This point is supported by more recent evidence from Brivanlou (2016). Using data for the S&P 500 Index stocks from 2005 to 2015, Brivanlou shows that the top 5% of dividend yielding stocks accounted for over 8% of the bottom decile of performance. This over-representation of very high dividend yielding stocks in the bottom decile of performance is likely attributable to deteriorating corporate fundamentals resulting in non-sustainable dividends.

## SUMMARY

A company’s cash dividend payment and share repurchase policies, taken together, constitute its payout policy. Both entail the distribution of the company’s cash to its shareholders, and each affects the form in which shareholders receive the return on their investment. Among the points this reading has made are the following:

- Dividends can take the form of regular or irregular cash payments, stock dividends, or stock splits. Only cash dividends are payments to shareholders. Stock dividends and splits merely carve equity into smaller pieces and do not create wealth for shareholders. Reverse stock splits usually occur after a stock has dropped to a very low price and do not affect shareholder wealth.
- Regular cash dividends—unlike irregular cash dividends, stock splits, and stock dividends—represent a commitment to pay cash to stockholders on a quarterly, semiannual, or annual basis.
- There are three general theories on investor preference for dividends. The first, MM, argues that given perfect markets dividend policy is irrelevant. The second, “bird in hand” theory, contends that investors value a dollar of dividends today more than uncertain capital gains in the future. The third theory argues that in countries in which dividends are taxed at higher rates than capital gains, taxable investors should prefer that companies reinvest earnings in profitable growth opportunities or repurchase shares so they receive more of the return in the form of capital gains.
- An argument for dividend irrelevance given perfect markets is that corporate dividend policy is irrelevant because shareholders can create their preferred cash flow stream by selling the company’s shares (“homemade dividends”).
- The clientele effect suggests that different classes of investors have differing preferences for dividend income. Those who prefer dividends will tend to invest in higher yielding shares.

**67** Glader, Laise, and Browning (2009).

**68** Madden (2008).

- Dividend declarations may provide information to current and prospective shareholders regarding management's confidence in the prospects of the company. Initiating a dividend or increasing a dividend sends a positive signal, whereas cutting a dividend or omitting a dividend typically sends a negative signal. In addition, some institutional, as well as individual, shareholders see regular cash dividend payments as a measure of investment quality.
- Payment of dividends can help reduce the agency conflicts between managers and shareholders, but it can worsen conflicts of interest between shareholders and debtholders.
- Empirically, several factors appear to influence dividend policy, including investment opportunities for the company, the volatility expected in its future earnings, financial flexibility, tax considerations, flotation costs, and contractual and legal restrictions.
- Under double taxation systems, dividends are taxed at both the corporate and shareholder level. Under tax imputation systems, a shareholder receives a tax credit on dividends for the tax paid on corporate profits. Under split-rate taxation systems, corporate profits are taxed at different rates depending on whether the profits are retained or paid out in dividends.
- Companies with outstanding debt often are restricted in the amount of dividends they can pay because of debt covenants and legal restrictions. Some institutions require that a company pay a dividend to be on their "approved" investment list. If a company funds capital expenditures by borrowing while paying earnings out in dividends, it will incur flotation costs on new debt issues.
- Using a stable dividend policy, a company tries to align its dividend growth rate to the company's long-term earnings growth rate. Dividends may increase even in years when earnings decline, and dividends will increase at a lower rate than earnings in boom years.
- According to Lintner (1956), the stable dividend policy can be represented by a gradual adjustment process in which the expected dividend is equal to last year's dividend per share plus  $[(\text{Expected earnings} \times \text{Target payout ratio}) - (\text{Previous dividend}) \times \text{Adjustment factor}]$ .
- Using a constant dividend payout ratio policy, a company applies a target dividend payout ratio to current earnings; therefore, dividends are more volatile than with a stable dividend policy.
- In a residual dividend policy, the amount of the annual dividend is equal to annual earnings minus the capital budget times the percent of the capital budget to be financed through retained earnings or zero, whichever is greater. An advantage of this policy to the company is that positive NPV opportunities have the first priority in the use of earnings.
- Share repurchases, or buybacks, most often occur in the open market. Alternatively, tender offers occur at a fixed price or at a price range through a Dutch auction. Shareholders who do not tender increase their relative position in the company. Direct negotiations with major shareholders to get them to sell their positions are less common because they could destroy value for remaining stockholders.
- Share repurchases made with excess cash have the potential to increase earnings per share, whereas share repurchases made with borrowed funds can increase, decrease, or not affect earnings per share, depending on the company's after-tax borrowing rate and earnings yield.
- A share repurchase is equivalent to the payment of a cash dividend of equal amount in its effect on total shareholders' wealth, all other things being equal.

- If the buyback market price per share is greater (less) than the book value per share, then the book value per share will decrease (increase).
- Companies can repurchase shares in lieu of increasing cash dividends. Share repurchases usually offer company management more flexibility than cash dividends by not establishing the expectation that a particular level of cash distribution will be maintained.
- Companies can pay regular cash dividends supplemented by share repurchases. In years of extraordinary increases in earnings, share repurchases can substitute for special cash dividends.
- On the one hand, share repurchases can signal that company officials think their shares are undervalued. On the other hand, share repurchases could send a negative signal that the company has few positive NPV opportunities.
- Analysts are interested in how safe a company's dividend is, specifically whether the company's earnings and, more importantly, its cash flow are sufficient to sustain the payment of the dividend.
- Early warning signs of whether a company can sustain its dividend include the dividend coverage ratio, the level of dividend yield, whether the company borrows to pay the dividend, and the company's past dividend record.

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## PRACTICE PROBLEMS

- 1 The payment of a 10% stock dividend by a company will result in an increase in that company's:
  - A current ratio.
  - B financial leverage.
  - C contributed capital.
- 2 If a company's common shares trade at very low prices, that company would be *most likely* to consider the use of a:
  - A stock split.
  - B stock dividend.
  - C reverse stock split.
- 3 In a recent presentation, Doug Pearce made two statements about dividends:
 

Statement 1 "A stock dividend will increase share price on the ex-dividend date, all other things being equal."

Statement 2 "One practical concern with a stock split is that it will reduce the company's price-to-earnings ratio."

Are Pearce's two statements about the effects of the stock dividend and stock split correct?

  - A No for both statements.
  - B Yes for Statement 1 and no for Statement 2.
  - C No for Statement 1 and yes for Statement 2.
- 4 All other things being equal, the payment of an internally financed cash dividend is *most likely* to result in:
  - A a lower current ratio.
  - B a higher current ratio.
  - C the same current ratio.
- 5 Match the phrases in Column A with the corresponding dividend theory in Column B. Note that you may use the answers in Column B more than once.

Column A	Column B
1. Bird in the hand	a) Dividend policy matters
2. Homemade dividends	b) Dividend policy is irrelevant
3. High tax rates on dividends	

- 6 Which of the following assumptions is *not* required for Miller and Modigliani's (MM) dividend theory?
  - A Shareholders have no transaction costs when buying and selling shares.
  - B There are no taxes.
  - C Investors sort themselves into dividend clienteles.
- 7 The clientele effect implies that:
  - A investors prefer high dividend paying shares.
  - B investors have varying preferences regarding dividends.
  - C low tax bracket investors are indifferent to dividends.

- 8 Sophie Chan owns 100,000 shares of PAT Company. PAT is selling for €40 per share, so Chan's investment is worth €4,000,000. Chan reinvests the gross amount of all dividends received to purchase additional shares. Assume that the clientele for PAT shares consists of tax-exempt investors. If PAT pays a €1.50 dividend, Chan's new share ownership after reinvesting dividends at the ex-dividend price is *most likely* to be closest to:
- A 103,600.  
B 103,750.  
C 103,900.
- 9 Which of the following is *most likely* to signal negative information concerning a company?
- A Share repurchase.  
B Decrease in the quarterly dividend rate.  
C A two-for-one stock split.
- 10 WL Corporation is located in a jurisdiction that has a 40% corporate tax rate on pretax income and a 30% personal tax rate on dividends. WL distributes all its after-tax income to shareholders. What is the effective tax rate on WL pretax income distributed in dividends?
- A 42%.  
B 58%.  
C 70%.
- 11 Which of the following factors is *least likely* to be associated with a company having a low dividend payout ratio?
- A High flotation costs on new equity issues.  
B High tax rates on dividends.  
C Low growth prospects.
- 12 The dividend policy of Berkshire Gardens Inc. can be represented by a gradual adjustment to a target dividend payout ratio. Last year Berkshire had earnings per share of US\$3.00 and paid a dividend of US\$0.60 a share. This year it estimates earnings per share will be US\$4.00. Find its dividend per share for this year if it has a 25% target payout ratio and uses a five-year period to adjust its dividend.
- A US\$0.68.  
B US\$0.80.  
C US\$0.85.
- 13 The Apex Corp. has a target capital structure of 40% debt and 60% equity. Its capital budget for next year is estimated to be US\$40 million. Estimated net income is US\$30 million. If Apex follows a residual dividend policy, its dividend is expected to be:
- A US\$6 million.  
B US\$12 million.  
C US\$18 million.
- 14 Beta Corporation is a manufacturer of inflatable furniture. Which of the following scenarios best reflects a stable dividend policy for Beta?
- A Maintaining a constant dividend payout ratio of 40–50%.  
B Maintaining the dividend at US\$1.00 a share for several years given no change in Beta's long-term prospects.

- C Increasing the dividend 5% a year over several years to reflect the two years in which Beta recognized mark-to-market gains on derivative positions.
- 15** A company has 1 million shares outstanding and earnings are £2 million. The company decides to use £10 million in idle cash to repurchase shares in the open market. The company's shares are trading at £50 per share. If the company uses the entire £10 million of idle cash to repurchase shares at the market price, the company's earnings per share will be *closest* to:
- A £2.00.  
 B £2.30.  
 C £2.50.
- 16** Devon Ltd. common shares sell at US\$40 a share, and their estimated price-to-earnings ratio (P/E) is 32. If Devon borrows funds to repurchase shares at its after-tax cost of debt of 5%, its EPS is *most likely* to:
- A increase.  
 B decrease.  
 C remain the same.
- 17** A company can borrow funds at an after-tax cost of 4.5%. The company's stock price is US\$40 per share, earnings per share is US\$2.00, and the company has 15 million shares outstanding. If the company borrows just enough to repurchase 2 million shares of stock at the prevailing market price, that company's earnings per share is *most likely* to:
- A increase.  
 B decrease.  
 C remain the same.
- 18** Crozet Corporation plans to borrow just enough money to repurchase 100,000 shares. The following information relates to the share repurchase:

Shares outstanding before buyback	3.1 million
Earnings per share before buyback	US\$4.00
Share price at time of buyback	US\$50
After-tax cost of borrowing	6%

- Crozet's earnings per share after the buyback will be *closest* to:
- A US\$4.03.  
 B US\$4.10.  
 C US\$4.23.
- 19** A company with 20 million shares outstanding decides to repurchase 2 million shares at the prevailing market price of €30 per share. At the time of the buyback, the company reports total assets of €850 million and total liabilities of €250 million. As a result of the buyback, that company's book value per share will *most likely*:
- A increase.  
 B decrease.  
 C remain the same.
- 20** An analyst gathered the following information about a company:

Number of shares outstanding	10 million
Earnings per share	US\$2.00
P/E	20
Book value per share	US\$30

If the company repurchases 1 million shares at the prevailing market price, the resulting book value per share will be *closest* to:

- A US\$26.
  - B US\$27.
  - C US\$29.
- 21 If a company's objective is to support its stock price in the event of a market downturn, it would be advised to authorize:
- A an open market share repurchase plan to be executed over the next five years.
  - B a tender offer share repurchase at a fixed price effective in 30 days.
  - C a Dutch auction tender offer effective in 30 days.
- 22 A company has positive free cash flow and is considering whether to use the entire amount of that free cash flow to pay a special cash dividend or to repurchase shares at the prevailing market price. Shareholders' wealth under the two options will be equivalent unless the:
- A company's book value per share is less than the prevailing market price.
  - B company's book value per share is greater than the prevailing market price.
  - C tax consequences and/or information content for each alternative is different.
- 23 Assume that a company is based in a country that has no taxes on dividends or capital gains. The company is considering either paying a special dividend or repurchasing its own shares. Shareholders of the company would have:
- A greater wealth if the company paid a special cash dividend.
  - B greater wealth if the company repurchased its shares.
  - C the same wealth under either a cash dividend or share repurchase program.
- 24 Investors may prefer companies that repurchase their shares instead of paying a cash dividend when:
- A capital gains are taxed at lower rates than dividends.
  - B capital gains are taxed at the same rate as dividends.
  - C the company needs more equity to finance capital expenditures.

## The following information relates to Questions 25–27

Janet Wu is treasurer of Wilson Chemical Company, a manufacturer of specialty chemicals used in industrial manufacturing and increasingly in technology applications. Wilson Chemical is selling one of its older divisions for US\$70 million cash. Wu is considering whether to recommend a special dividend of US\$70 million or a repurchase of 2 million shares of Wilson common stock in the open market. She is reviewing some possible effects of the buyback with the company's financial analyst.

Wilson has a long-term record of gradually increasing earnings and dividends. Wilson's board has also approved capital spending of US\$15 million to be entirely funded out of this year's earnings.

Book value of equity	US\$750 million (US\$30 a share)
Shares outstanding	25 million
12-month trading range	US\$25–US\$35
Current share price	US\$35
After-tax cost of borrowing	7%
Estimated full year earnings	US\$25 million
Last year's dividends	US\$9 million
Target capital structure (market value)	35% debt, 65% equity

- 25 Wilson's share buyback could be a signal that the company:
- A is decreasing its financial leverage.
  - B views its shares as undervalued in the marketplace.
  - C has more investment opportunities than it could fund internally.
- 26 Assume that Wilson Chemical funds its capital spending out of its estimated full year earnings. If Wilson uses a residual dividend policy, determine Wilson's implied dividend payout ratio.
- A 36%.
  - B 40%.
  - C 60%.
- 27 The most likely tax environment in which Wilson Chemical's shareholders would prefer that Wilson repurchase its shares (share buybacks) instead of paying dividends is one in which:
- A the tax rate on capital gains and dividends is the same.
  - B capital gains tax rates are higher than dividend income tax rates.
  - C capital gains tax rates are lower than dividend income tax rates.

## The following information relates to questions 28–33

John Ladan is an analyst in the research department of an international securities firm. Ladan is currently analyzing Yeta Products, a publicly traded global consumer goods company located in the United States. Selected data for Yeta are presented in Exhibit 1.

### Exhibit 1 Selected Financial Data for Yeta Products

Most Recent Fiscal Year	Current
Pretax income	\$280 million
Net income after tax	\$182 million
Cash flow from operations	\$235 million

*(continued)*

**Exhibit 1 (Continued)**

Most Recent Fiscal Year	Current
Capital expenditures	\$175 million
Earnings per share	\$1.82

Yeta currently does not pay a dividend, and the company operates with a target capital structure of 40% debt and 60% equity. However, on a recent conference call, Yeta's management indicated that they are considering four payout proposals:

- Proposal #1: Issue a 10% stock dividend.
- Proposal #2: Repurchase \$40 million in shares using idle cash.
- Proposal #3: Repurchase \$40 million in shares by borrowing \$40 million at an after-tax cost of borrowing of 8.50%.
- Proposal #4: Initiate a regular cash dividend based on a residual dividend policy.

- 28** The implementation of Proposal #1 would generally lead to shareholders:
- A having to pay tax on the dividend received.
  - B experiencing a decrease in the total cost basis of their shares.
  - C having the same proportionate ownership as before implementation.
- 29** If Yeta's management implemented Proposal #2 at the current share price shown in Exhibit 1, Yeta's book value per share after implementation would be *closest* to:
- A \$25.20.
  - B \$25.71.
  - C \$26.12.
- 30** Based on Exhibit 1, if Yeta's management implemented Proposal #3 at the current share price, earnings per share would:
- A decrease.
  - B remain unchanged.
  - C increase.
- 31** Based on Exhibit 1 and Yeta's target capital structure, the total dividend that Yeta would have paid last year under a residual dividend policy is *closest* to:
- A \$77 million.
  - B \$112 million.
  - C \$175 million.
- 32** Based on Yeta's target capital structure, Proposal #4 will *most likely*:
- A increase the default risk of Yeta's debt.
  - B increase the agency conflict between Yeta's shareholders and managers.
  - C decrease the agency conflict between Yeta's shareholders and bondholders.
- 33** The implementation of Proposal #4 would *most likely* signal to Ladan and other investors that future earnings growth can be expected to:
- A decrease.
  - B remain unchanged.
  - C increase.

## SOLUTIONS

- 1 C is correct. A stock dividend is accounted for as a transfer of retained earnings to contributed capital.
- 2 C is correct. A reverse stock split would increase the price per share of the stock to a higher, more marketable range that could possibly increase the number of investors who would consider buying the stock.
- 3 A is correct. Both statements are incorrect. A stock dividend will decrease the price per share, all other things being equal. A stock split will reduce the price and earnings per share proportionately, leaving the price-to-earnings ratio the same.
- 4 A is correct. By reducing corporate cash, a cash dividend reduces the current ratio, whereas a stock dividend (whatever the size) has no effect on the current ratio.
- 5 The appropriate matches are as follows:

Column A	Column B
1. Bird in the hand	a) Dividend policy matters
2. Homemade dividends	b) Dividend policy is irrelevant
3. High tax rates on dividends	a) Dividend policy matters

- 6 C is correct. The MM dividend theory assumes no taxes or transaction costs, but it does not assume a clientele effect.
- 7 B is correct. The clientele effect implies that there are varying preferences for dividends among distinct investor groups.
- 8 C is correct. Because the clientele for PAT investors has the same tax rate (zero) for dividends and capital gains, the ex-dividend stock price of PAT should decline by the amount of the dividend to  $\$40 - \$1.50 = \$38.50$ . Chan will purchase  $\$150,000/\$38.50 = 3,896$  additional shares. This increases her total shares owned to 103,896. Chan's new share ownership is closest to 103,900.
- 9 B is correct. A decrease in the quarterly dividend rate is likely to signal negative information. A decrease is typically understood as signaling poor future business prospects.
- 10 B is correct. The effective tax rate can be computed as 1 minus the fraction of 1 unit of earnings that investors retain after all taxes, or  $1 - (1 - 0.40)(1 - 0.30) = 0.58$  or 58% effective tax rate. Another way to obtain the solution: Corporate taxes =  $1.00 \times 0.40 = 0.40$  and Personal taxes = 0.60 in dividends  $\times 0.30 = 0.18$ , so Total tax =  $0.40 + 0.18 = 0.58$ , a 58% effective rate.
- 11 C is correct. With low growth prospects, a company would typically have a high payout ratio, returning funds to its shareholders rather than retaining funds.
- 12 A is correct. The estimated dividend per share is US\$0.68.

Previous DPS = US\$0.60

Expected EPS = US\$4

Target payout ratio = 0.25

Five-year adjustment factor =  $1/5 = 0.2$

$$\begin{aligned}\text{Expected dividend} &= \text{Previous dividend} + (\text{Expected earnings} \\ &\quad \times \text{Target payout ratio} - \text{Previous dividend}) \times \\ &\quad \text{Adjustment factor} \\ &= \$0.60 + [(\$4.00 \times 0.25 - \$0.60) \times 0.2] \\ &= \$0.60 + \$0.08 \\ &= \$0.68\end{aligned}$$

- 13** A is correct. Using the residual dividend policy, with a target capital structure of 40% debt and 60% equity, 60% or US\$24 million of the US\$40 million in capital expenditures will be financed with equity; US\$30 million net income – US\$24 million retained earnings = US\$6 million for dividends.
- 14** B is correct. Choice A is consistent with a target payout ratio policy. Choice C is not correct because the earnings increases described are not sustainable long term.
- 15** C is correct. At the current market price, the company can repurchase 200,000 shares ( $\$10 \text{ million}/\$50 = 200,000 \text{ shares}$ ). The company would have 800,000 shares outstanding after the repurchase ( $1 \text{ million shares} - 200,000 \text{ shares} = 800,000 \text{ shares}$ ). EPS before the buyback is £2.00 ( $\$2 \text{ million}/1 \text{ million shares} = \$2.00$ ). Total earnings after the buyback are the same because the company uses idle (nonearning) cash to purchase the shares, but the number of shares outstanding is reduced to 800,000. EPS increases to £2.50 ( $\$2 \text{ million}/800,000 \text{ shares} = \$2.50$ ).
- 16** B is correct. If the P/E is 32, the earnings-to-price ratio (earnings yield or E/P) is  $1/32 = 3.125\%$ . When the cost of capital is greater than the earnings yield, earnings dilution will result from the buyback.
- 17** A is correct. The company's earnings yield (E/P) is  $\$2/\$40 = 0.05$ . When the earnings yield is greater than the after-tax cost of borrowed funds, EPS will increase if shares are repurchased using borrowed funds.
- 18** A is correct.

Total earnings before buyback:  $\$4.00 \times 3,100,000 \text{ shares} = \$12,400,000$

Total amount of borrowing:  $\$50 \times 100,000 \text{ shares} = \$5,000,000$

After-tax cost of borrowing the amount of funds needed:  $\$5,000,000 \times 0.06 = \$300,000$

Number of shares outstanding after buyback:  $3,100,000 - 100,000 = 3,000,000$

EPS after buyback:  $(\$12,400,000 - \$300,000)/3,000,000 \text{ shares} = \$4.03$

The P/E before the buyback is  $\$50/\$4 = 12.5$ ; thus, the E/P is 8%. The after-tax cost of debt is 6%; therefore, EPS will increase.

- 19** C is correct. The company's book value before the buyback is €850 million in assets – €250 million in liabilities = €600 million. Book value per share is  $\$600 \text{ million}/20 \text{ million} = \$30 \text{ per share}$ . The buyback will reduce equity by 2 million shares at the prevailing market price of €30 per share. The book value of equity will be reduced to  $\$600 \text{ million} - \$60 \text{ million} = \$540 \text{ million}$ , and the number of shares will be reduced to 18 million;  $\$540 \text{ million}/18 \text{ million} = \$30 \text{ book value per share}$ . If the prevailing market price is equal to the book value per share at the time of the buyback, book value per share is unchanged.

- 20** C is correct. The prevailing market price is US\$2.00(20) = US\$40.00 per share; thus, the buyback would reduce equity by US\$40 million. Book value of equity before the buyback is US\$300 million. Book value of equity after the buyback would be US\$300 million – US\$40 million = US\$260 million. The number of shares outstanding after the buyback would be 9 million. Thus, book value per share after the buyback would be US\$260 million/9 million = US\$28.89 ≈ US\$29.
- 21** A is correct. Of the three methods, only an authorized open market share repurchase plan allows the company the flexibility to time share repurchases to coincide with share price declines.
- 22** C is correct. For the two options to be equivalent with respect to shareholders' wealth, the amount of cash distributed, the taxation, and the information content must be the same for both options.
- 23** C is correct. When there are no taxes, there are no tax differences between dividends and capital gains. All other things being equal, the effect on shareholder wealth of a dividend and a share repurchase should be the same.
- 24** A is correct. When capital gains are taxed at lower rates than dividends, investors may prefer companies that return cash to shareholders through share repurchases rather than dividends.
- 25** B is correct. Management sometimes undertakes share repurchases when it views shares as being undervalued in the marketplace.
- 26** B is correct. Earnings available for dividends = Earnings – Capital spending = US\$25 million – US\$15 million = US\$10 million; US\$10 million/US\$25 million = 40% dividend payout ratio.
- 27** C is correct. Shareholders would prefer that the company repurchase its shares instead of paying dividends when the tax rate on capital gains is lower than the tax rate on dividends.
- 28** C is correct. The implementation of Proposal #1, a stock dividend, would not affect a shareholder's proportionate ownership because all shareholders would receive the same proportionate increase in shares. Stock dividends, which are generally not taxable to shareholders, do not impact an investor's total cost basis (they merely reduce the cost basis per share).
- A is incorrect because stock dividends are generally not taxable to shareholders. A stock dividend merely divides the "pie" (the market value of shareholders' equity) into smaller pieces.
- B is incorrect because an investor's total cost basis will not be affected by a stock dividend; a stock dividend merely reduces the cost basis per share.
- 29** B is correct. If Yeta implemented Proposal #2, a repurchase of \$40 million in shares, the resulting book value per share (BVPS) would be \$25.71, calculated as follows:
- 1 Yeta has a current BVPS of \$25.60; therefore, total book value of equity is \$2,560 million (= \$25.60 × 100,000,000 shares).
  - 2 The number of shares Yeta would repurchase is \$40 million/\$20.00 per share = 2 million shares.
  - 3 Yeta shareholders' book value of equity after the buyback would be \$2,520 million (= \$2,560 million – \$40 million).
  - 4 The number of shares after the buyback would be 98 million (= 100 million – 2 million).
  - 5 The BVPS after the buyback would be \$2,520 million/98 million = \$25.71.

A is incorrect because \$25.20 incorrectly uses 100 million shares instead of 98 million shares in calculating BVPS after the buyback: \$2,520 million/100 million = \$25.20.

C is incorrect because \$26.12 incorrectly uses \$2,560 million (current book value) instead of \$2,520 million as the book value of equity in calculating BVPS after the buyback. The BVPS after the buyback is incorrectly calculated as \$2,560 million/98 million = \$26.12.

- 30** C is correct. In the case of external funding, a company's earnings per share will increase if the stock's earnings yield, which is the ratio of earnings per share to share price, exceeds the after-tax cost of borrowing. Yeta's earnings yield is 9.10% ( $= \$1.82/\$20.00$ ), which exceeds the after-tax cost of borrowing of 8.50%.

A is incorrect because EPS will increase (not decrease) if the stock's earnings yield ( $= \$1.82/\$20.00$ ) exceeds the after-tax cost of borrowing. Yeta's earnings yield of 9.10% exceeds the after-tax cost of borrowing of 8.50%.

B is incorrect because EPS will increase (not remain unchanged) if the stock's earnings yield ( $= \$1.82/\$20.00$ ) exceeds the after-tax cost of borrowing. Yeta's earnings yield of 9.10% exceeds the after-tax cost of borrowing of 8.50%.

- 31** A is correct. The dividend under a residual dividend policy would be \$77 million, calculated as follows:

\$ Millions	
Net income after tax (earnings)	\$182
Capital spending	\$175
Financing from new debt ( $0.4 \times \$175$ )	\$70
Financing from retained earnings ( $0.6 \times \$175$ )	\$105

B is incorrect because \$112 million incorrectly subtracts financing from new debt rather than financing from retained earnings in the calculation of dividend paid:

\$ Millions	
Net income after tax (earnings)	\$182
Capital spending	\$175
Financing from new debt ( $0.4 \times \$175$ )	\$70
Financing from retained earnings ( $0.6 \times \$175$ )	\$105
Residual earnings = dividend paid ( $\$182 - \$70$ )	\$112

C is incorrect because \$175 million incorrectly uses net income before taxes rather than net income after taxes (earnings) in the calculation:

\$ Millions	
Net income before taxes	\$280
Capital spending	\$175
Financing from new debt ( $0.4 \times \$175$ )	\$70
Financing from retained earnings ( $0.6 \times \$175$ )	\$105
Residual earnings = dividend paid ( $\$280 - \$105$ )	\$175

**32** A is correct. Yeta is financed by both debt and equity; therefore, paying dividends can increase the agency conflict between shareholders and bondholders. The payment of dividends reduces the cash cushion available for the disbursement of fixed required payments to bondholders. All else equal, dividends increase the default risk of debt.

B is incorrect because the agency conflict between shareholders and managers would decrease (not increase) with the payment of dividends. Paying out free cash flow to equity in dividends would constrain managers in their ability to overinvest by taking on negative net present value (NPV) projects.

C is incorrect because paying dividends can increase (not decrease) the agency conflict between shareholders and bondholders. The payment of dividends would reduce the cash cushion available to Yeta for the disbursement of fixed required payments to bondholders. The payment of dividends transfers wealth from bondholders to shareholders and increases the default risk of debt.

**33** C is correct. Dividend initiations convey positive information and are associated with future earnings growth, whereas dividend omissions or reductions convey negative information and are associated with future earnings problems.

A is incorrect because dividend initiations convey positive information and are associated with an expected increase (not a decrease) in future earnings growth. Dividend omissions or reductions convey negative information and are associated with future earnings problems.

B is incorrect because dividend initiations convey positive information and are associated with an expectation that future earnings growth will increase (not remain unchanged). In contrast, dividend omissions or reductions convey negative information and are associated with future earnings problems.



CORPORATE FINANCE  
STUDY SESSION

# 8

## Corporate Finance (2)

This study session presents two major organizational topics of corporate finance. The first topic presented is environmental, social, and governance (ESG) considerations in investment analysis. The process for identifying ESG-related risks and opportunities relevant to security analysis are described. ESG considerations provide analysts with a broader perspective of the risks and investment opportunities of a company's securities. Next, mergers, acquisitions, and corporate restructurings—which create changes in ownership and control—are examined to determine whether 1) value is created from the transaction and 2) acquisition price is justified by the transaction's benefits.

### READING ASSIGNMENTS

- |                   |   |
|-------------------|---|
| <b>Reading 22</b> | Corporate Governance and Other ESG Considerations in Investment Analysis<br>by Deborah S. Kidd, CFA, Young Lee, CFA, and Johan Vanderlugt |
| <b>Reading 23</b> | Mergers and Acquisitions<br>by Rosita P. Chang, PhD, CFA, and Keith M. Moore, CFA   |



## READING

# 22

## Corporate Governance and Other ESG Considerations in Investment Analysis

by Deborah S. Kidd, CFA, Young Lee, CFA, and Johan Vanderlugt

*Deborah S. Kidd, CFA (USA). Young Lee, CFA, is at MacKay Shields LLC (USA) and MacKay Shields UK LLP (United Kingdom). Johan Vanderlugt is at NN Investment Partners (Netherlands).*

### LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. describe global variations in ownership structures and the possible effects of these variations on corporate governance policies and practices;
<input type="checkbox"/>	b. evaluate the effectiveness of a company's corporate governance policies and practices;
<input type="checkbox"/>	c. describe how ESG-related risk exposures and investment opportunities may be identified and evaluated;
<input type="checkbox"/>	d. evaluate ESG risk exposures and investment opportunities related to a company.

### INTRODUCTION

1

Environmental, social, and governance (ESG) considerations are increasingly being integrated into investment analysis. Evaluating how ESG factors potentially affect a company may provide analysts with a broader perspective on the risks and investment opportunities of a company's securities. Although corporate governance has long been recognized as having a significant impact on a company's long-term performance, investors have become increasingly concerned with environmental and social factors and how companies manage their resources and risk exposures that relate to such factors. Mismanagement of these resources has led to a number of high-profile corporate events that have negatively affected security prices. Increasingly stringent regulatory environments, potentially finite supplies of natural resources, and global trends toward energy conservation and waste reduction have led many investors to

place a greater emphasis on the management of environmental risks. Similarly, such issues as worker health and safety policies, community impact, and marketing practices have increased the visibility of how a company manages its social capital.

This reading provides an overview of ESG considerations in investment analysis. Section 2 provides an overview of the global variations in corporate ownership structures, as well as how these ownership structures may affect corporate governance outcomes. In Section 3, we discuss company-specific factors that should be considered when evaluating corporate governance in the investment process. Section 4 discusses the identification of ESG-related risks and opportunities that are relevant to security analysis. Section 5 demonstrates the evaluation of ESG-related risks and opportunities through several examples. The reading concludes with a summary of the key points discussed.

## 2

## GLOBAL VARIATIONS IN OWNERSHIP STRUCTURES

The global corporate governance landscape comprises a vast range of ownership structures that reflect unique economic, political, social, legal, and other forces in each country and/or region. Within any of these distinct ownership structures, one may find a variety of complex relationships involving shareholders and other stakeholders who have an interest in the company. Such other stakeholders include creditors, managers (executives), employees, directors, customers, suppliers, governments, and regulators. An understanding of the variation of ownership structures, the conflicts that arise within these structures, types of influential shareholders, and the effects of ownership structure on corporate governance are important considerations for analyzing corporate governance in the investment process.

### 2.1 Dispersed vs. Concentrated Ownership

Corporate ownership structures are generally classified as *dispersed*, *concentrated*, or a hybrid of the two. **Dispersed ownership** reflects the existence of many shareholders, none of which have the ability to individually exercise control over the corporation. In contrast, **concentrated ownership** reflects an individual shareholder or a group (called *controlling shareholders*) with the ability to exercise control over the corporation. In this context, a group is typically a family, another company (or companies), or a sovereign entity.

On a global basis, concentrated ownership structures are considerably more common than dispersed ownership structures. A global corporate governance report by the Organisation for Economic Co-Operation and Development (OECD)<sup>1</sup> noted that 38 out of 47 jurisdictions analyzed have predominantly concentrated ownership structures. Among the other nine jurisdictions, four were characterized as having dispersed ownership structures (Australia, Ireland, the United Kingdom, and the United States) and five were characterized as having “hybrid” corporate ownership structures (Canada, Germany, Japan, the Netherlands, and Switzerland). The OECD’s classification of corporate ownership structure by jurisdiction is shown in Exhibit 1.

<sup>1</sup> OECD (2017).

**Exhibit 1 Corporate Ownership Classifications****Jurisdictions with Concentrated Ownership**

Austria, Belgium, Brazil, Chile, China, Colombia, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, India, Indonesia, Israel, Italy, Latvia, South Korea, Mexico, New Zealand, Norway, Poland, Portugal, Russia, Singapore, Slovenia, South Africa, Spain, Sweden, Turkey

State ownership is characteristic of certain countries, such as China, Norway, and Sweden. In other countries, including Brazil, South Korea, Mexico, and Portugal, families are the predominant shareholders. Company groups are prevalent in a number of additional countries, such as India and Russia.

**Jurisdictions with Dispersed Ownership**

Australia, Ireland, United Kingdom, United States

Among the largest companies in Australia, the majority of shares are held (albeit dispersed) by financial institutions. In Ireland, ownership shares tend to be widely dispersed, although there are a few family-controlled companies. Among UK companies, few have major shareholders owning 25% or more of shares. In the United States, ownership of public companies is generally characterized by dispersed shareholdings; listed companies are rarely under the control of a major shareholder.

**Hybrid Jurisdictions**

Canada, Germany, Japan, Netherlands, Switzerland

In Canada, among the largest listed firms, a meaningful minority have controlling shareholders. In Germany, a significant number of companies are under “tight control,” but in many cases shares are broadly distributed (especially for listed companies). In Japan, a small minority of listed companies have a shareholder that owns a majority of shares. The Netherlands has a more dispersed ownership structure than most continental European countries; however, when accounting for “trust offices,” ownership is somewhat more concentrated. In Switzerland, the largest listed companies have more dispersed ownership than medium-sized and smaller companies.

*Source:* OECD (2017).

The degree of share ownership alone may not necessarily reflect whether the control of a company is dispersed or concentrated. This is true because controlling shareholders may be either **majority shareholders** (i.e., own more than 50% of a corporation’s shares) or **minority shareholders** (i.e., own less than 50% of shares). In many ownership structures, shareholders may have disproportionately high control of a corporation relative to their ownership stakes as a result of horizontal and/or vertical ownership arrangements. **Horizontal ownership** involves companies with mutual business interests (e.g., key customers or suppliers) that have cross-holding share arrangements with each other. This structure can help facilitate strategic alliances and foster long-term relationships among such companies. **Vertical ownership** (or pyramid ownership) involves a company or group that has a controlling interest in two or more holding companies, which in turn have controlling interests in various operating companies.

The existence of *dual-class* (or multiple-class) shares can also serve to disconnect the degree of share ownership from actual control. **Dual-class shares** grant one share class superior or even sole voting rights, whereas the other share class has inferior or no voting rights. When used in connection with vertical ownership arrangements,

the company or group at the top of the pyramid can issue to itself all or a disproportionately high number of shares with superior voting rights and thus maintain control of the operating companies with relatively fewer total shares of a company owned.

## 2.2 Conflicts within Different Ownership Structures

The type of corporate ownership structure affects corporate governance policies and practices because of the potentially different set of conflicts that may exist between shareholders and managers, as well as among shareholders themselves.

The combination of *dispersed* ownership and *dispersed* voting power is generally associated with shareholders who lack the power to exercise control over managers. These shareholders are referred to as *weak shareholders*, and such managers are referred to as *strong managers*. Under this combination, conflict between the shareholders and managers of a corporation may be significant. Shareholders are interested in maximizing shareholder value. However, there is a risk that managers will seek to use a company's resources to pursue their own interests. In corporate governance, this conflict is known as a *principal–agent* problem. This problem can be mitigated if controlling shareholders are present because they may be able to control the board of directors (and, in turn, the appointment of managers) and have the incentive to monitor management.

The combination of *concentrated* ownership and *concentrated* voting power often results in controlling shareholders maintaining a position of power over both managers and minority shareholders; these controlling shareholders are referred to as *strong shareholders*, and such managers are referred to as *weak managers*. In this scenario, controlling shareholders can effectively monitor management because they are able to control the board of directors and, in turn, the appointment of managers. However, with concentrated ownership and concentrated voting power, controlling owners may also be able to allocate company resources to their own benefit at the expense of minority owners. This conflict is known as a *principal–principal* problem.

The combination of *dispersed* ownership and *concentrated* voting power generally leads to the principal–principal problem. The one difference, however, is that the strong controlling shareholders do not own a majority of the shares of a company. In this scenario, controlling shareholders with less than majority ownership can exert control over other minority owners through certain mechanisms, such as dual-class share structures and pyramid structures, and can also monitor management owing to their outsized voting power.

Finally, the combination of *concentrated* ownership and *dispersed* voting power arises when there are legal restrictions on the voting rights of large share positions, known as **voting caps**. Voting caps have been imposed by a number of sovereign governments to deter foreign investors from obtaining controlling ownership positions in strategically important local companies.

### EXAMPLE 1

#### Conflicts between Shareholders and Managers

The managers of Company A collectively own approximately 60% of the outstanding shares. Each ownership share has equivalent voting rights. Describe the potential conflict between the shareholders and managers of Company A given its ownership structure and voting rights.

**Solution:**

Company A has concentrated ownership and concentrated voting power. In this ownership structure, shareholders do not appear to have the ability to control or monitor managers; that is, there are weak shareholders and strong managers. In this case, a risk exists that managers may seek to use company resources to prioritize their own interests rather than to maximize shareholder value. This type of conflict is known as the *principal–agent* problem.

## 2.3 Types of Influential Shareholders

In different parts of the world, the types of corporate shareholders that have a significant influence on corporate governance vary. Each of these shareholder types possesses its own unique set of motivations, interests, and agendas. By identifying these shareholders, an investment analyst is in a position to further assess corporate governance risks.

### 2.3.1 Banks

In several regions, notably in Europe and Asia, banks often have considerable control over corporations with which they have a lending relationship as well as an equity interest. A conflict of interest could arise if banks have loan exposures to a corporation in addition to their equity investment. For example, if a bank has both a lending relationship with and an equity interest in a corporation, it could seek to influence the corporation to take out large loans, and perhaps on less favorable terms, to the potential detriment of other shareholders. In this situation, appropriate corporate governance controls could ensure that banks that are both creditors and investors appropriately balance their interests as lenders against their interests as shareholders.

### 2.3.2 Families

Family ownership is the predominant form of corporate structure in some parts of the world, notably Latin America and, to a slightly lesser extent, Asia and Europe. In some cases, also commonly in Latin America, individuals serve on the board of directors of multiple corporations. This situation, known as **interlocking directors**, typically results in the same family or the same member of a corporate group controlling several corporations. A benefit of family control is lower risks associated with principal–agent problems as a result of families having concentrated ownership and management responsibility. Conversely, drawbacks of family ownership may include poor transparency, lack of management accountability, modest consideration for minority shareholder rights, and difficulty in attracting quality talent for management positions.

### 2.3.3 State-Owned Enterprises

State-owned enterprises (SOEs) often exist in corporate sectors that are strategically important to a sovereign government, have minimum initial or ongoing capital requirements that are beyond the private sector's funding ability, or provide certain products or services (e.g., power generation or health services) that the state believes should be provided at a certain price or minimum standard. Listed SOEs are partially owned by sovereign governments but also have shares traded on public stock markets. This structure is called a *mixed-ownership model*. This model tends to have lower market scrutiny of management than that of corporate ownership models where there are implicit or explicit state guarantees to prevent corporate bankruptcy. In some cases, SOEs may pursue policies that enhance social or public policy considerations at the expense of maximizing shareholder value.

#### **2.3.4 Institutional Investors**

In many countries, institutional investors—typically mutual funds, pension funds, insurance companies, and hedge funds—collectively represent a significant proportion of equity market ownership. Because these investors tend to have considerable resources and market expertise, they can use informed judgment in exercising their shareholder rights. In markets with widely dispersed ownership, institutional investors do not typically control a large enough ownership position to qualify as a controlling shareholder. However, institutional investors can promote good corporate governance by holding a company's board and management accountable when the board or management does not appear to be acting in the best interests of shareholders.

#### **2.3.5 Group Companies**

Some ownership structures, such as the previously mentioned horizontal and vertical ownership structures, may result in shareholders having disproportionately high control relative to their ownership stakes. Cross-holding share arrangements and long-term relationships between these group companies may restrict the potential for a transfer of share ownership—as well as create a potential obstacle for outsiders to purchase a significant portion of shares in companies. Without appropriate corporate governance policies/procedures or regulatory protections, there is a greater risk that corporations controlled by groups engage in related-party transactions at the expense of minority shareholders. Examples of group companies are Samsung (South Korea), Sanwa (Japan), and Grupo Carso (Mexico).

#### **2.3.6 Private Equity Firms**

Private equity firms, notably those involved in venture capital and leveraged buyouts, are strategic owners that invest in privately owned companies or in public companies with the intent to take them private. Venture capital firms invest in the early stages of a company and provide oversight of portfolio companies. Similarly, leveraged buyout (LBO) firms typically have majority control in mature companies. The involvement of venture capital and LBO firms in the management of corporations may bring important changes to companies' corporate governance, such as the development of corporate codes and implementation of performance-based manager compensation.

#### **2.3.7 Foreign Investors**

Foreign investors, particularly when investing in emerging market countries, can have a significant influence on local companies when they own more shares than domestic investors own. Foreign investors from countries that have more stringent standards may demand higher levels of transparency and accountability. If a local company chooses to cross-list its shares in another country with greater transparency requirements and investor protections, local minority shareholders may benefit from the arrangement.

#### **2.3.8 Managers and Board Directors**

When managers and board directors are also shareholders of a company, they are known as **insiders**. As their ownership positions increase, insiders are more likely to dedicate company resources toward long-term profitability since their economic interests in the company have become more aligned with the interests of external shareholders. However, large ownership positions may also provide insiders with increased power and an accompanying desire to protect their own interests at the expense of other shareholders.

## 2.4 Effects of Ownership Structure on Corporate Governance

This subsection highlights the effects of ownership structures on corporate governance policies and practices. Key considerations include board independence; board structure; special voting arrangements; corporate governance codes, laws, and listing requirements; and stewardship codes.

### 2.4.1 Director Independence

**Independent board directors** (or independent board members) are defined as those with no material relationship with the company with regard to employment, ownership, or remuneration. The percentage of independent board directors tends to be higher in jurisdictions with generally dispersed ownership structures relative to those countries with generally concentrated ownership structures. Independent directors originated in dispersed ownership jurisdictions as a means to strengthen the board's monitoring role over managers. The proportion of independent directors on boards has increased over time amid regulatory responses to corporate scandals (e.g., the Enron Corporation scandal in the early 2000s).

Independent directors generally serve a narrower role in concentrated ownership structures than in dispersed ownership structures. For example, the United States requires that some committees (such as the audit, nomination, and compensation committees) be composed entirely of independent directors. Conversely, in most jurisdictions with concentrated ownership structures, nomination and remuneration committees are not mandatory; when these committees do exist, jurisdictions typically recommend that the committees be wholly or largely composed of independent directors. In short, the principal–agent problem is generally less of a concern in a concentrated ownership structure than in a dispersed ownership structure.

Almost all OECD countries have introduced a requirement or recommendation for the level of independent directors serving on boards. However, these requirements and recommendations vary by jurisdiction. Some countries impose or recommend a minimum number of independent directors (typically ranging from one to three), whereas others impose or recommend a minimum ratio of independent directors (typically ranging from 20% to 50% or greater).

### 2.4.2 Board Structures

A corporation's board of directors is typically structured as either one tier or two tier. A **one-tier board** structure consists of a single board of directors, composed of executive (internal) and non-executive (external) directors. A **two-tier board** structure consists of a supervisory board that oversees a management board. A one-tier board is the most common board structure, but a number of jurisdictions mandate a two-tier board structure (e.g., Argentina, Germany, and Russia) whereas other jurisdictions offer the choice of a one-tier or two-tier board (e.g., Brazil and France). The supervisory board of a two-tier board can serve as a control function through activities such as inspecting the corporation's books and records, reviewing the annual report, overseeing the work of external auditors, analyzing information provided by the management board, and setting or influencing management compensation. In certain countries, such as Germany, the supervisory boards comprise representatives from key stakeholders, such as banks and labor or other groups.

### 2.4.3 Special Voting Arrangements

Several jurisdictions have special voting arrangements to improve the position of minority shareholders. For example, Brazil, India, Portugal, Turkey, Italy, Israel, and the United Kingdom have special arrangements that facilitate engagement of minority shareholders in board nomination and election processes. When a United Kingdom company has a controlling shareholder, a condition for obtaining a "premium listing"

(i.e., meeting the United Kingdom's highest standards of regulation and corporate governance) on the London Stock Exchange is that independent directors must be separately approved by both the entire shareholder base and non-controlling shareholders.

#### 2.4.4 Corporate Governance Codes, Laws, and Listing Requirements

Many countries have adopted national corporate governance codes in which companies disclose their adoption of recommended corporate governance practices or explain why they have not done so. In some jurisdictions, companies are required to go beyond this “comply or explain” approach. In Japan, for example, companies with no outside directors must justify why appointing outside directors is not appropriate. Some jurisdictions do not have national corporate governance codes but make use of company law or regulation (e.g., Chile) or stock exchange listing requirements (e.g., India) to achieve similar objectives.

#### 2.4.5 Stewardship Codes

Many countries have introduced voluntary codes, known as *stewardship codes*, that encourage investors to exercise their legal rights and increase their level of engagement in corporate governance. In some cases, stewardship codes are not entirely voluntary. As an example, the UK Stewardship Code includes a duty for institutional investors to monitor the companies in which they invest and requires that UK asset managers investing in the shares of UK companies publish a “comply or explain” statement of commitment to the UK Stewardship Code.

## 3

## EVALUATING CORPORATE GOVERNANCE POLICIES AND PROCEDURES

Effective corporate governance is critical for a company's reputation and competitiveness. Benefits of effective corporate governance may include higher profitability, growth in return on equity (or other return metrics), better access to credit, higher and sustainable dividends, favorable long-term share performance, and a lower cost of capital. In contrast, companies with ineffective corporate governance may experience reputational damage, reduced competitiveness, potential share price weakness/volatility, reduced profitability, and a higher cost of capital.

Corporate governance factors are often difficult to quantify. However, an understanding of these factors and their impact on governance policies and procedures can be an important consideration for investors. Understanding the disclosed corporate governance policies and procedures is a key starting point for investors. Regular dialogue and engagement efforts with companies can help investors better understand corporate governance policies and procedures. In some situations, shareholder activism can be used to attempt to compel a company to act in a desired manner. **Shareholder activism** refers to strategies used by shareholders to attempt to compel a company to act in a desired manner.

The quality of corporate governance is typically reflected in a company's behavior in the market and toward its stakeholders. To that end, an evaluation of a corporation's board of directors is a starting point for investors. We discuss several of the considerations relating to boards of directors in this section. In addition, a company's policies regarding business ethics, bribery and corruption, whistleblower protection, and related-party transactions can help analysts evaluate a company's corporate governance. In practice, analysts typically adjust the risk premium (cost of capital) or credit spread of a company to reflect their assessment of corporate governance considerations.

### **3.1 Board Policies and Practices**

A starting point for evaluating a board's effectiveness is its policies and practices. An oversight role is one aspect of a board's effectiveness—for example, whether the board is high performing or dysfunctional. Each capital market is subject to different corporate governance issues, depending on its predominant ownership structure, history, legal environment, culture, and industry diversity. For example, boards of companies with concentrated family ownership structures and concentrated voting power may engage in related-party transactions that benefit family members or affiliates at the expense of outside shareholders.

#### **3.1.1 *Board of Directors Structure***

Generally, when evaluating board structure, investors consider whether the organization and structure of the board—whether it is a one-tier or two-tier structure—provide sufficient oversight, representation, and accountability to shareholders. A related topic is “CEO duality,” whereby the chief executive officer (CEO) also serves as chairperson of the board. CEO duality may raise concerns that the monitoring and oversight role of the board may be compromised relative to independent chairperson and CEO roles. When the chairperson is not independent or the role is combined, a company may appoint a lead independent director to help protect investor interests.

#### **3.1.2 *Board Independence***

The independence of the directors, which we discussed previously, is a relevant consideration for investors. The absence or presence of a minority of independent directors is a negative aspect of corporate governance. Without independent directors, the potential for management to act in a self-serving manner exists. Consequently, a lack of independent directors on a board may increase investors’ perception of the corporation’s risk.

#### **3.1.3 *Board Committees***

The number of board committees and how the committees operate are relevant considerations in an investor’s analysis of governance. Committees vary by corporation and industry but generally include audit, governance, remuneration (or compensation), nomination, and risk and compliance committees. When evaluating a company’s board committees, investors assess whether there are sufficiently independent committees that focus on key governance concerns, such as audit, compensation, and the selection of directors. The presence of non-independent committee members or executive directors may prompt the consideration of potential conflicts of interest or biases, such as those relating to compensation decisions (remuneration committee), management selection (nomination committee), and the integrity of financial reporting (audit committee).

#### **3.1.4 *Board Skills and Experience***

The underlying skill set and experience of board directors are important investor considerations. A board with concentrated skills and experience may lack sufficient expertise to govern, as may a board with diverse skills and expertise that are not directly related to the company’s core operations. In certain sectors/industries that rely on natural resources or face potentially large ESG risks, board members typically have expertise in environmental, climate, or social issues.

An issue related to skills and experience is board tenure. According to many corporate governance codes, a board director’s tenure is considered long if it exceeds 10 years. Long tenure of a board member could be viewed positively or negatively. On the positive side, a board member with a long tenure may have a comprehensive understanding of how the corporation’s business operates, as well as how effective

company management has been during the director's tenure. On the negative side, long tenure may affect the independence of board members (i.e., they could be too closely aligned with management) or may result in directors being less willing to embrace changes in the corporation's business.

### **3.1.5 Board Composition**

Board composition primarily reflects the number and diversity of directors, including their professional, cultural, and geographical background, as well as gender, age, and tenure. Boards with too many members or that lack diversity may govern less effectively than boards that are smaller and more diverse. For example, a board with long-tenured board members could become controlling, self-serving, or resistant to the introduction of new practices or policies that may be beneficial to stakeholders.

### **3.1.6 Other Considerations in Board Evaluation**

Board evaluation is necessary to maintain a company's competitive position and to meet the expectations of investors, as indicated by the widely recognized Cadbury Report, issued in the United Kingdom in 1992. Dimensions of the board evaluation process may include who evaluates the board, what should be evaluated, to whom the evaluation is targeted, and how the evaluation will be accomplished.

A board evaluation can be performed by the board itself (self-evaluation) or by an outsider on behalf of the board (external review). Some boards may decide to evaluate their performance on an "as needed" basis, whereas others will prefer to conduct a periodic external review. A board evaluation typically covers how the board performs its duties, its leadership, its structure (including the committees), and the interaction between board members and management (including culture). Apart from internal stakeholders, the evaluation may be targeted to the company's shareholders, regulators, or other external stakeholders.

#### **EXAMPLE 2**

### **Evaluating the Board of Directors**

A junior analyst is analyzing the board of directors of Style, a fictional global clothing retailer based in Italy. Style was founded by the Donato family and is publicly traded. Style's 11-member board of directors has a chairperson—who is not the CEO—and two independent directors. Among the six non-independent directors, the Donato family accounts for four of them. All these family members have served on the board for at least 20 years. The gender and age of the board is diverse, with women representing five of the board's directors—including its chair, Leila Donato—and the age of directors ranging from 35 to 75 years old.

Describe considerations that the junior analyst would use in evaluating the effectiveness of Style's board of directors.

#### **Solution:**

The CEO and chairperson roles are separate for Style (no CEO duality), which can be considered a sign of effective corporate governance. In addition, the board appears to be diverse in terms of age and gender, which is typically considered a positive attribute. Conversely, board independence appears to be substandard: Only two board directors are independent, whereas four Donato family members, including the chairperson (Leila Donato), are board members. The tenure of the family board members is also likely to be considered a negative attribute (it far exceeds the typical 10 years).

### 3.2 Executive Remuneration

Executive remuneration involves such issues as transparency of compensation, performance criteria for incentive plans (both short term and long term), the linkage of remuneration with the company strategy, and the pay differential between the CEO and the average worker. When a corporation has a “say-on-pay” provision, shareholders can vote and/or provide feedback on remuneration issues. A claw-back policy allows a company to recover previously paid remuneration if certain events, such as financial restatements, misconduct, breach of the law, or risk management deficiencies, are uncovered.

There is increasing concern among investors regarding “excessive” remuneration, often represented by the ratio of CEO pay to average-worker pay. In evaluating a company’s executive remuneration, investors typically consider whether the company’s remuneration policies and practices provide appropriate incentives for management to drive the value of a corporation. Company disclosures such as those metrics (also known as key performance indicators, or KPIs) used in executive incentive plans may be useful tools for analysis.

### 3.3 Shareholder Voting Rights

Shareholder voting rights are important investor considerations. Under **straight voting** share structures, shareholders are granted the right of one vote for each share owned. Dual-class share structures differ from straight voting in that company founders and/or management typically have shares with more voting power than the class of shares available to the general public. That is, dual-class share structures—in contrast to the one share, one vote principle of straight voting—can benefit one group of shareholders over another. Because a potential conflict of interest may exist between minority shareholders and the company’s founders and management (some of whom may also serve on the board of directors), it is important for investors to be aware of dual-class share structures when investing.

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## IDENTIFYING ESG-RELATED RISKS AND OPPORTUNITIES

4

A primary challenge when integrating ESG factors into investment analysis is identifying and obtaining information that is relevant and useful. In practice, ESG-related data are generally obtained from publicly available corporate filings, documents, and communications. A challenge analysts face is that ESG information and metrics may be reported inconsistently by companies. Another challenge is that most ESG-related disclosures are voluntary for many companies, and the level of voluntary disclosure varies. ESG-related disclosure has generally increased over time, however, because of increased stakeholder and shareholder interest in understanding ESG risks and issues.

### 4.1 Materiality and Investment Horizon

When considering ESG factors in investment analysis, analysts need to evaluate the *materiality* of the underlying data. In an ESG context, materiality typically refers to ESG-related issues that are expected to affect a company’s operations, its financial performance, and the valuation of its securities. In overall financial reporting, information is considered to be material if omission or misstatement of the information could influence users’ decisions. Companies’ definitions of materiality in an ESG context

may differ in usefulness. Some companies may use the term “material” in emphasizing positive ESG information, although such information may have little impact on the company’s operations or financial performance. In contrast, a company may minimize or not report negative ESG information that investors might consider material.

Analysts also consider their investment horizon when deciding which ESG factors to consider in their analysis. Some ESG issues may affect a company’s performance in the short term, whereas other issues may be more long term in nature. An investor with a short-term investment horizon may find that longer-term ESG issues have little impact on a security’s valuation in the near term. Consider a manufacturing company operating in an industry that is expected to face stricter environmental regulations in the future. An investor with a short-term horizon may expect that the company’s profitability will not be affected in the short term. An investor with a long-term horizon, however, may anticipate costly upgrades to plants and equipment or significant regulatory fines that are likely to reduce profitability over the longer term.

## 4.2 Relevant ESG-Related Factors

Corporate governance considerations, such as the structure of the board of directors, are often reasonably consistent across most companies. In contrast, environmental and social considerations often differ greatly. When identifying a company’s specific ESG risks and opportunities, analysts must determine the relevant factors that affect its industry. For example, energy companies are clearly affected by environmental factors, whereas banking institutions are typically affected more by social factors (e.g., data security and privacy issues) than by environmental factors. Meanwhile, both industries are subject to governance factors. Once an analyst has determined which ESG-related factors are relevant to a company’s industry, the analyst can identify applicable qualitative and quantitative data.

Approaches used to identify a company’s (or industry’s) ESG factors include (1) proprietary methods, (2) ESG data providers, and (3) not-for-profit industry organizations and initiatives. With the proprietary method approach, analysts use their own judgment or their firm’s proprietary tools to identify ESG information by researching companies, news reports, industry associations, environmental groups, financial markets, labor organizations, industry experts, and government organizations. Company-specific ESG data are generally publicly available from such sources as annual reports, corporate citizenship or sustainability reports, proxy reports, and regulatory filings (e.g., the annual 10-K report required by the US Securities and Exchange Commission). Company disclosures can generally be found on company websites.

Exhibit 2 illustrates an example of how one ESG-related issue—greenhouse gas emissions (GHG)—is disclosed by Valero Energy in its sustainability report. Note that other energy companies (e.g., ExxonMobil and Pemex) report GHG differently. In fact, ESG disclosures in general can range from minimal reporting to comprehensive data and information that span several pages, thus potentially creating comparability issues for analysts. As we discuss later in this section, a number of organizations and initiatives are working toward voluntary or mandatory standardization of various ESG-related metrics.

### **Exhibit 2 Greenhouse Gas Emissions Disclosure for Valero Energy**

Valero closely follows regulatory developments and participates in professional and public-policy forums that address greenhouse gases. Valero intends to continue to reduce its greenhouse-gas and other air emissions through adoption of new technologies, and improved and more efficient operations. The average per-barrel greenhouse-gas emissions for 2012–2016 decreased by 14 percent from

**Exhibit 2 (Continued)**

the previous five-year average, according to most-recent available data. Through initiatives such as flare-gas recovery, on-site power and steam cogeneration and alternative energy, Valero continues to produce clean and renewable fuels for the world's energy needs.

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*Source:* Valero, "2017 Social Responsibility Report."

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The second approach in identifying company/industry ESG factors—ESG data providers—involves the use of information supplied by an ESG data provider (vendor), such as MSCI or Sustainalytics. The information obtained by vendors is reflected in individual ESG analyses, scores, and/or rankings for each company in the vendor's universe. In addition, vendors may score and/or rank companies within their industries and provide detailed industry analyses relating to ESG considerations.

The third approach in identifying ESG factors—not-for-profit industry organizations and initiatives—involves the consideration of not-for-profit initiatives that provide data and insights on ESG issues. These include the International Integrated Reporting Council (IIRC), the Global Reporting Initiative (GRI), and the Sustainable Accounting Standards Board (SASB). The IIRC is a coalition of industry participants that promotes a standardized framework of ESG disclosures in corporate reporting. The GRI has worked with various stakeholder groups to develop sustainability reporting standards. These standards include a list of business activity groups (industries) with relevant sustainability topics that correspond to each group. A GRI report excerpt relating to the consumer durables and household and personal products sector is shown in Exhibit 3. The exhibit indicates the proposed ESG-related topics for this sector as well as additional specifications on these topics, if available. The SASB seeks to promote uniform accounting standards for sustainability reporting. In doing so, the SASB has developed the SASB Materiality Map, which lists relevant ESG-related, sector-specific factors that the organization deems to be material. Exhibit 4 displays a sample SASB Materiality Map that shows the key ESG factors (shaded boxes) for the health care sector.

**Exhibit 3 GRI Sustainability Topics—Consumer Durables and Household and Personal Products Sector**

Category	Proposed Topic	Topic Specification (where applicable)
Environmental	Materials sourcing	Rare metals; Sourcing standards for raw materials; Sourcing standards on animal testing; Wood-based products from responsibly managed forests
	Product packaging	Not applicable
	Plastic use	Product and packaging
	Chemicals use	International and national chemical safe use regulations; Personal care products; Phthalates and parabens
	Energy efficiency of end products	Consumer electronics
	Life cycle assessment of products	Not applicable
	Product transport efficiency	Not applicable
Social	Migrant workers	Recruitment and employment
	Product safety	Personal care products—human health and the environment

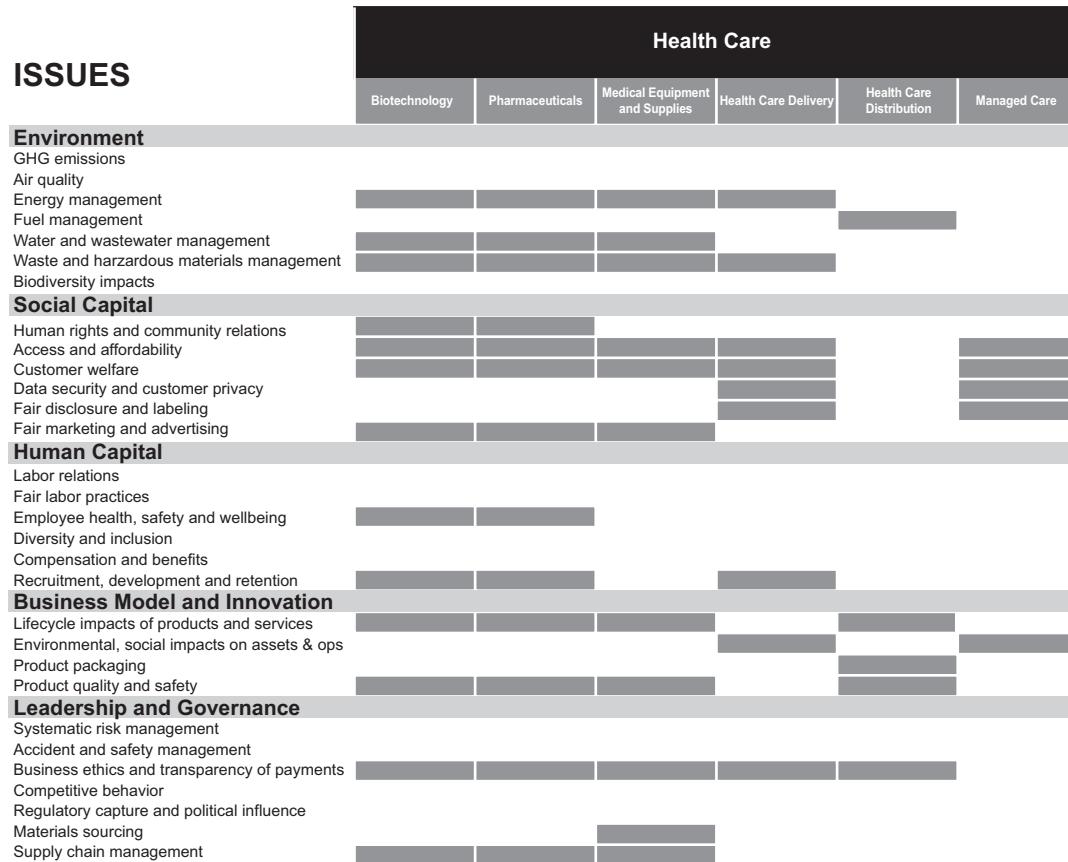
*(continued)*

### Exhibit 3 (Continued)

Category	Proposed Topic	Topic Specification (where applicable)
Other	Transparent product information and labeling	Not applicable
	Access to products, technologies, and services	Consumers with disabilities
	Electronic waste (e-waste) management	Consumer awareness
	Product design	Eco-friendly personal care products
	Product innovation	Energy consumption, GHG emissions and packaging
Other	Corporate governance	Executive board compensation; Gender participation on governance bodies
	Supplier screening	Environmental and social standards in the supply chain

Source: GRI, "Sustainability Topics for Sectors: What Do Stakeholders Want to Know?" (2013).

### Exhibit 4 SASB Materiality Map—Health Care Sector



Source: Sustainability Accounting Standards Board.

### 4.3 Equity vs. Fixed-Income Security Analysis

From a risk/reward perspective, the use of **ESG integration**—the implementation of qualitative and quantitative ESG factors in traditional security and industry analysis—typically differs for equity and fixed-income (debt) analysis. In equity analysis, ESG integration is used to both identify potential opportunities and mitigate downside risk, whereas in fixed-income analysis, ESG integration is generally focused on mitigating downside risk.

The process of identifying and evaluating relevant ESG-related factors is reasonably similar for both equity and corporate credit analysis. However, ESG integration differs considerably between equities and fixed income with respect to valuation. In equity security analysis, ESG-related factors are often analyzed in the context of forecasting financial metrics and ratios, adjusting valuation model variables (e.g., discount rate), or using sensitivity and/or scenario analysis. For example, an analyst might increase her forecast of a hotel company's operating costs because of the impacts of excessive employee turnover—lost productivity, reduced customer satisfaction, and increased expenses for employee searches, temporary workers, and training programs. As another example, an analyst might choose to lower the discount rate for a snack food company that is expected to gain a competitive advantage by transitioning to a sustainable source of a key ingredient in its products.

In credit analysis, ESG factors may be integrated using internal credit assessments, forecasting financial ratios, and relative credit ranking of companies (or governments). In terms of valuation, relative value, spread, duration, and sensitivity/scenario analysis is often used. For example, an analyst may include the effect of lawsuits on the credit ratios, cash flow, or liquidity of a toy company. The same analyst may also estimate the potential for the credit spreads of the toy company's bonds to widen from these lawsuits. Generally speaking, the effect on the credit spreads of an issuer's debt obligations or its credit default swaps (CDSs) may differ depending on maturity. As a different example, consider an analyst who believes that a coal company faces long-term risk from potential **stranded assets**—that is, assets that are obsolete or not economically viable, often owing to changes in regulatory or government policy or shifts in demand. In this case, the analyst may believe that valuation of the coal company's 10-year-maturity notes would be considerably more negatively affected than its 1-year-maturity notes.

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## EVALUATING ESG-RELATED RISKS AND OPPORTUNITIES

5

By integrating ESG considerations into the investment process, investors can take a broader perspective of company and industry analysis. In this way, the potential effects of ESG factors on a company's financial statements and valuation can be assessed and, in turn, can help drive investment decisions. In this section, we discuss examples of how ESG considerations can be integrated in financial analysis and valuation, from both an equity and a corporate bond perspective.

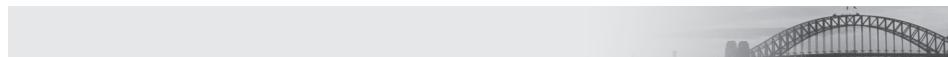
### 5.1 ESG Integration

A typical starting point for ESG integration is the identification of material qualitative and quantitative ESG factors that pertain to a company or its industry. An analyst may evaluate these factors on both a historical and a forecast basis, as well as relative to a company's peers, and then make relevant adjustments to a company's financial

statements or valuation. ESG-related adjustments to a company's income statement and cash flow statement typically relate to projected revenues, operating/non-operating costs, operating margins, earnings, capital expenditures, or other items. ESG-related adjustments to a company's balance sheet often reflect an analyst's estimate of impaired assets. For equities, valuation adjustments often include adjusting a company's cost of capital using the discount rate or a multiple of price or terminal value. For bonds, an analyst may adjust an issuer's credit spread or CDS to reflect anticipated effects from ESG considerations.

The use of qualitative and quantitative research, as well as securities valuation of equities and fixed income, are key elements of the "ESG Integration Framework" that CFA Institute and the Principles for Responsible Investment (PRI) developed in the 2018 joint publication "*ESG Integration In The Americas: Markets, Practices, And Data*". Portfolio construction, asset allocation, scenario analysis, and risk management form the remainder of this framework.

One particular type of bond an analyst might encounter in ESG integration is a **green bond**. The sidebar "Green Bonds" provides more details about these securities and how investors typically analyze them. Increasingly, investors use scenario analysis and stress tests to assess the potential impact of key factors, such as risks from climate change.



## Green Bonds

Green bonds are bonds in which the proceeds are designated by issuers to fund a specific project or portfolio of projects that have environmental or climate benefits. The first green bond, the Climate Awareness Bond, was issued by the European Investment Bank in 2007. Issuers have the primary decision for labeling their bonds "green." This decision is made in close cooperation with the lead underwriter. At a minimum level, issuers provide detail to the investors about the green eligibility criteria for the use of proceeds, in line with the Green Bond Principles (discussed in the next paragraph). Issuers are responsible for providing investors with details on the criteria used to classify the bonds as green and how the bond's proceeds are used. In some cases, issuers may commission independent reviews of the green criteria to provide investors with greater transparency. Issuers of green bonds typically incur additional costs related to the monitoring and reporting of the use of the bond's proceeds. However, these issuers may benefit from a more diversified investor base and potentially a new-issue premium if demand is strong.

The Green Bond Principles, a set of voluntary standards to guide issuers in the determination of labeling a bond green, were developed in 2014 by a consortium of investment banks. Ongoing monitoring and further development of the Green Bond Principles is the responsibility of the International Capital Market Association, a global securities self-regulatory organization. As the green bond market has evolved, index providers, credit rating agencies, and the not-for-profit Climate Bonds Initiative have developed their own methodologies or standards to assess labeled green bonds. In addition, the European Commission is exploring the feasibility of imposing specific criteria that must be met for a bond to be labeled green.

Green bonds are typically similar to an issuer's conventional bonds, with the exception that the bond proceeds are earmarked for green projects. Green bonds normally have the same credit ratings and bondholder recourse as conventional bonds of the same issuer (all else being equal). In addition to conventional or "plain vanilla" corporate bonds, other types of green bonds include project bonds, mortgage-backed and asset-backed securities, and municipal bonds. For example, the state of California's \$300 million general obligation 2014 green bond issue is backed by the state's General Fund, just as California's other general obligation bonds are.

Because only the use of proceeds differs, the analysis and valuation of green bonds are essentially the same as those of conventional bonds. However, some green bonds may command a premium, or tighter credit spread, versus comparable conventional bonds because of market demand. One unique risk of green bonds is **greenwashing**, which is the risk that the bond's proceeds are not actually used for a beneficial environmental or climate-related project. Greenwashing can result in an investor overpaying for a bond (if the investor paid a premium for the bond's green feature) or holding a bond that does not satisfy a prescribed environmental or climate investment mandate. Liquidity risk may also be a consideration for green bonds, given that they are often purchased by buy-and-hold investors.

## 5.2 Examples of ESG Integration

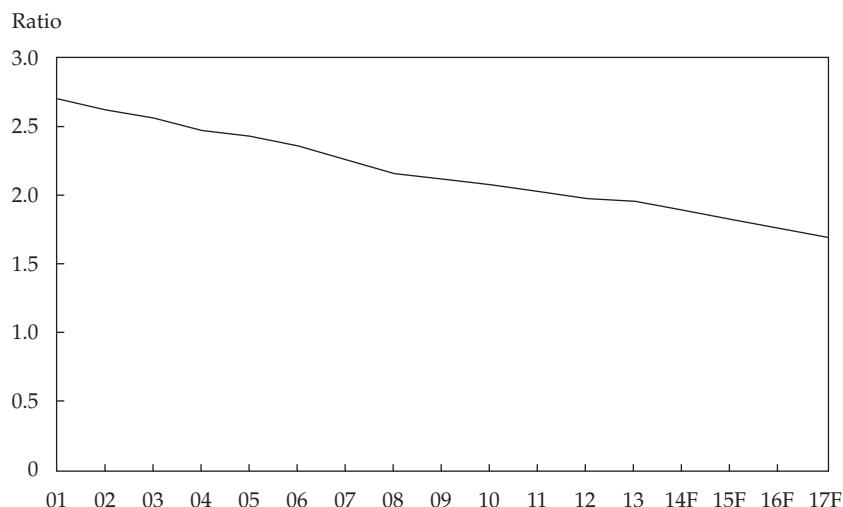
This section provides examples of ESG integration for three fictitious companies in different industries: beverages, pharmaceuticals, and banks. To simplify the examples, each integration example focuses on either environmental, social, or governance factors—largely depending on which is most relevant for that company or its industry. Note that although specific industries are used in the examples, the underlying concepts can be applied to other industries as well. Finally, given the scope of this reading, we focus on the *effects* of ESG integration on financial analysis and valuation rather than the computations involved.

### EXAMPLE 3

#### ESG Integration—Environmental Factors (Beverage Company)

Based in the United States, Frizzle Drinks (Frizzle) is a fictitious non-alcoholic beverage company that ranks among the largest in the world. Frizzle operates in both developed and emerging markets, including countries in which water is scarce. Frizzle is a significant user of water in its operations. Given that water is a key ingredient in Frizzle's beverages, the continued availability of water is critical to the company's manufacturing process. Because of its extensive use of water, Frizzle faces ongoing regulatory scrutiny for pollution and effects on climate change. Ultimately, how Frizzle conserves and manages its water usage has implications for product pricing and company/brand reputation.

Sam Smith, CFA, is analyzing the effects of environmental factors on Frizzle's financial statements. Based on his research, Smith considers "water intensity" to be a key ESG metric for the beverage industry. Water intensity is defined as the ratio of total liters of water used per one liter of a beverage product. Exhibit 5 illustrates the trend of Frizzle's water intensity ratio from 2X01 to 2X13, as well as the consensus forecast ratio for the subsequent four years. Frizzle has steadily decreased its water usage over the past several years. From 2X01 to 2X13, its water intensity ratio declined by 27%. By the end of 2X17(F), the company aims to reduce its water intensity by another 13%.

**Exhibit 5 Water Intensity Ratio (in liters)**

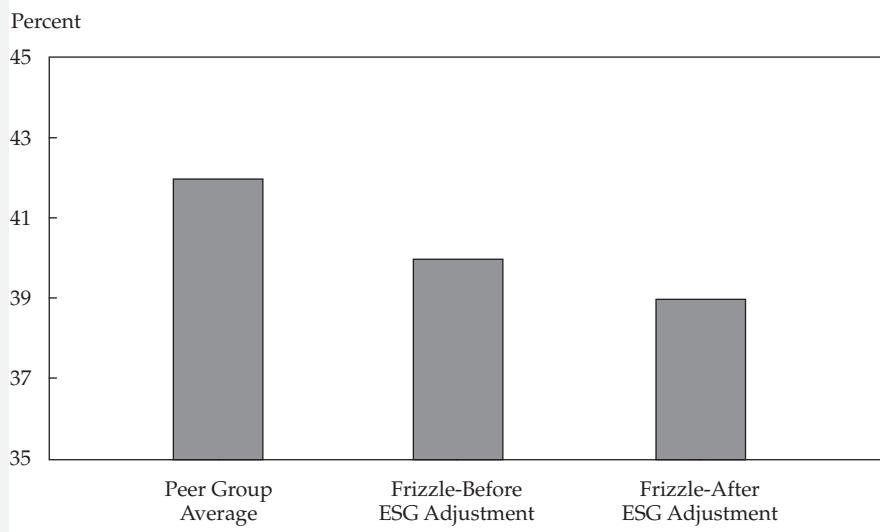
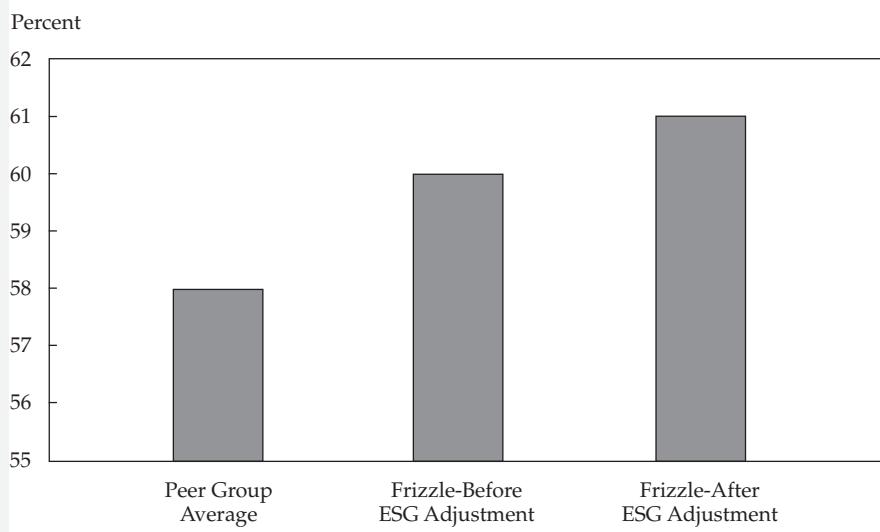
Note: (F) indicates forecast year.

Exhibit 6 compares the year-over-year change in Frizzle's water intensity ratio compared with that of its peer group over the past three years. To facilitate comparison among companies of varying sizes, Smith adjusts the reported water intensity ratios to reflect \$1 million of revenue. Exhibit 6 illustrates that Frizzle's water intensity has decreased considerably relative to its peers over the past few years, particularly in the last reported year, 2X13.

**Exhibit 6 Water Intensity Ratio Change per \$1 Million of Revenue**

Next, Smith analyzes the effects of Frizzle's water intensity on its overall financial performance and compares it with the adjusted financial performance of its peers. As one example, Smith adjusts Frizzle's operating costs to account for the improved effects of water intensity (i.e., reduced usage). For the first projected year, 2X14, Smith expects that Frizzle's cost of goods sold as a percentage of revenues (before any ESG adjustment) will be 40% and its peer group average will be 42%. For the same forecast period, Smith assumes that Frizzle's reduction

in water intensity will result in a 1% reduction in its cost of goods sold/revenues whereas the peer group average will remain the same. Exhibit 7 demonstrates this improvement in cost of goods sold/revenues on both an absolute and a relative basis. By extension, Exhibit 8 shows the absolute and relative improvement in Frizzle's gross margin (sales minus cost of goods sold) percentage.

**Exhibit 7 Cost of Goods Sold as a Percentage of Revenue**

**Exhibit 8 Gross Margin**


In the last step of the integration analysis, Smith incorporates Frizzle's adjusted financial performance in valuing Frizzle's stock, bonds, and, if applicable, CDSs. In this example, Smith judges that Frizzle's lower cost of goods sold from the adjustment would result in higher forecast earnings and, all else being equal, a theoretically higher fair value for Frizzle's stock. With respect to Frizzle's bonds and CDSs, Frizzle's operating cash flow would improve through

a lower cost of goods sold. Note that the potential effects on the credit spreads of Frizzle's bonds or CDSs may be limited if any modest creditworthiness is already reflected in current spread levels.

**EXAMPLE 4****ESG Integration—Social Factors (Pharmaceutical Company)**

Well Pharma (Well) is a European pharmaceutical company that manufactures drug products for autoimmune diseases and immune disorders. Over the last five years, Well has had the weakest track record among its peers in terms of product recalls and regulatory warning letters for manufacturing and marketing-related violations. Specifically, the company has been subject to four major drug quality and safety scandals arising from adverse side effects. These scandals have resulted in lost sales, multiple lawsuits, and significant fines. Business disruptions, lawsuits, and fines have reduced revenues and increased costs for the company.

As Well's experience shows, product quality is a material social factor for pharmaceutical companies in general. Smith assumes that a drug company's product quality is a combination of the factors shown in Exhibit 9.

**Exhibit 9 Social Factors—Pharmaceuticals**

Factor	Description
Product Quality Controversies	Have there been any controversies linked to the company's product or service quality and responsibility?
Regulatory Warning Letters	Number of regulatory warning letters received by the company
Product Recalls	Number and severity of product recalls (voluntary and involuntary)
Regulatory Fines	Level of fines imposed by regulator linked to poor product quality and/or irresponsible behavior

Exhibit 10 shows the number of regulatory warning letters received, as well as product and marketing controversies faced, by Well and several peers. As the graph shows, Well has received significantly more of these letters than its peers have.

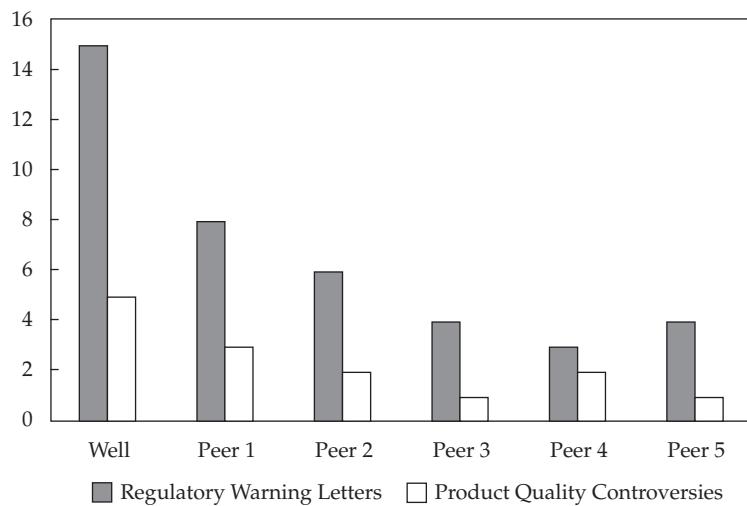
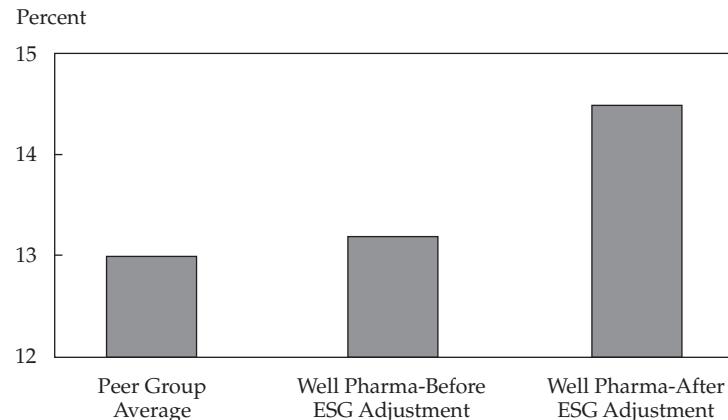
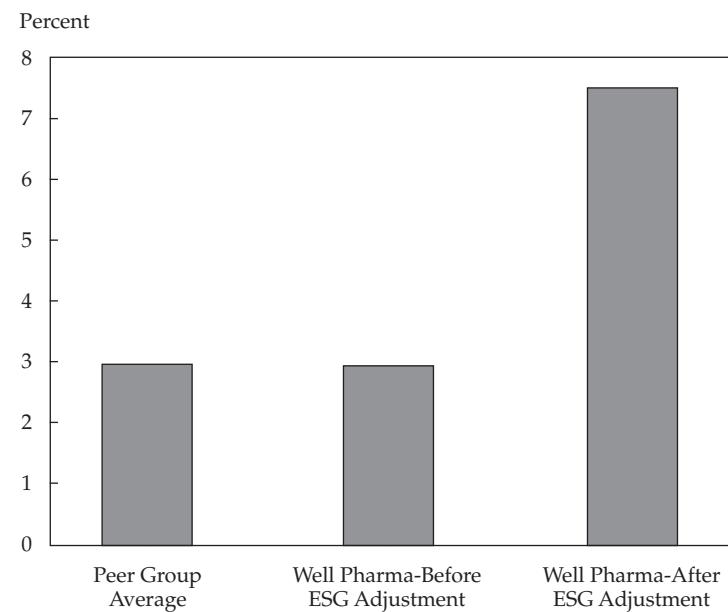
**Exhibit 10 Regulatory Warning Letters and Product Quality Controversies**


Exhibit 11 demonstrates how the factors listed in Exhibit 9 may affect the financial statements of Well and other pharmaceutical companies.

**Exhibit 11 Social Factor Effects on Financial Performance**

Factor	Financial Impact
Product Quality Controversies	Damage to brand value resulting in potential decrease in sales
Regulatory Warning Letters	Increased costs to comply with regulatory requirements
Product Recalls	Losses in sales revenue; increased costs of implementing product recalls
Regulatory Fines	Provisions for pharmaceutical sales returns and product-related litigation

Based on these financial effects, Smith adjusts Well's projected revenues, operating expenses, and non-operating expenses. The nature of these financial statement adjustments will likely differ depending on whether Smith expects these product quality issues to be recurring or non-recurring in nature. Smith assumes that revenues will decrease by 2% over the next year because of existing product quality controversies. For operating expenses, Smith assumes that Well's cost of goods sold relative to revenues will increase by 1.3% to reflect product quality, regulatory issues, and additional investments in its manufacturing process. Exhibit 12 shows that Well's cost of goods sold as a percentage of revenues is in line with that of its peers, but the additional costs will increase this ratio well above that of the peer group. In addition to operating expenses, Smith forecasts that Well's non-operating expenses, such as restructuring charges, and other non-recurring costs will be an additional 4.5% of operating income. Exhibit 13 shows the current non-operating expense ratio for Well versus its peer group average, as well as the forecast amount.

**Exhibit 12 Cost of Goods Sold as a Percentage of Revenue****Exhibit 13 Non-Operating Expenses as a Percentage of Operating Income**

Smith believes that the valuation implications for Well's stock and bonds could be significant based on its poor product quality and safety track record. Expectations of future poor performance could have a direct impact on earnings and cash flow to the detriment of both shareholders and bondholders. In addition, Smith believes there could be adverse valuation implications if investors view Well's brand value and reputation as impaired.

**EXAMPLE 5****ESG Integration—Governance Factors (Bank Holding Company)**

Sumiyoshi Banking Group (Sumiyoshi) is a major Japanese bank holding company, with operations in Japan (80% of revenues), the United States, and Southeast Asia. Sumiyoshi's core businesses are commercial banking, leasing, securities, and consumer finance. As with most global banks, corporate governance reforms have become increasingly prominent for Sumiyoshi following the 2008–09 global financial crisis.

Smith has prepared Exhibit 14 to show how Sumiyoshi's board of directors compares with the majority of its domestic peer group, on the basis of governance factors discussed in Section 2 of this reading.

**Exhibit 14 Corporate Governance Factors—Banks**

	<b>Domestic peer group</b>	<b>Sumiyoshi Bank</b>
Board type	Two tier	Two tier
Board size, no. of directors	13	14
Total assets/director	JPY14.9 million	JPY13.3 million
CEO duality	Yes	Yes
Independent chairperson	Yes	No
Board independence %	47%	36%
Board gender diversity	17% female; 83% male	7% female; 93% male
Directors with long tenure (>10 years)	0%	14%
Number of board committees	5	4
Audit, nomination, remuneration, and risk committees in place?	Yes	Yes
Additional board committees?	Yes, governance committee	No
Non-executive directors with industry executive experience/total independent directors	67%	20%
Short-term and long-term incentive plan metrics disclosed?	No	No
Concentrated ownership	No single large shareholder	No single large shareholder
Say-on-pay provision	Yes	No
Straight voting	Yes	Yes
Dual-class shares	No	No

Smith notes that Sumiyoshi lags its peers in several elements of board composition, such as the lack of an independent chairperson, a lower level of board independence and diversity, fewer board members with industry executive experience, and a number of board directors with long tenures. In addition to board composition, Smith uses credit risk as a proxy for a bank's corporate governance risk. In particular, Smith reviews one key banking credit measure—non-performing loans (NPLs). NPLs are loans that are not current in paying the contractual amounts that are due (i.e., interest or principal payments).

Smith analyzes Sumiyoshi's credit risk by dividing its NPLs by the amount of its total loans outstanding. Smith estimates that Sumiyoshi's ratio of NPLs to total loans is 50 bps higher than its peer group average, reflecting Sumiyoshi's comparatively weaker credit/governance risk. To account for the effect of higher credit risk than that of its peers, Smith may increase the risk premium embedded in his valuation of Sumiyoshi's stock. When valuing Sumiyoshi's corporate bonds, Smith might increase the credit spread relative to peers embedded in the company's outstanding issues.

## SUMMARY

- Shareholder ownership structures are commonly classified as dispersed, concentrated, or a hybrid of the two.
- Dispersed ownership reflects the existence of many shareholders, none of which, either individually or collectively, has the ability to exercise control over the corporation. Concentrated corporate ownership reflects an individual shareholder or a group (controlling shareholders) with the ability to exercise control over the corporation.
- Controlling shareholders may be either majority shareholders or minority shareholders.
- Horizontal ownership involves companies with mutual business interests that have cross-holding share arrangements with each other. Vertical (or pyramid) ownership involves a company or group that has a controlling interest in two or more holding companies, which in turn have controlling interests in various operating companies.
- Dual-class (or multiple-class) shares grant one or more share classes superior or even sole voting rights while other share classes have inferior or no voting rights.
- Types of influential owners include banks, families, sovereign governments, institutional investors, group companies, private equity firms, foreign investors, managers, and board directors.
- A corporation's board of directors is typically structured as either one tier or two tier. A one-tier board consists of a single board of directors, composed of executive (internal) and non-executive (external) directors. A two-tier board consists of a supervisory board that oversees a management board.
- CEO duality exists when the chief executive officer also serves as chairperson of the board.
- A primary challenge of integrating ESG factors in investment analysis is identifying and obtaining information that is relevant and useful.
- ESG information and metrics are inconsistently reported by companies, and such disclosure is voluntary, which provides additional challenges for analysts.
- In an ESG context, materiality typically refers to ESG-related issues that are expected to affect a company's operations or financial performance and the valuation of its securities.

- Corporate governance considerations, such as the structure of the board of directors, tend to be reasonably consistent across most companies. In contrast, environmental and social considerations often differ greatly.
- Analysts typically use three approaches to identify a company's (or industry's) ESG factors: (1) proprietary research, (2) ESG data providers, or (3) not-for-profit industry organizations and initiatives.
- In equity analysis, ESG integration is used to both identify potential opportunities and mitigate downside risk, whereas in fixed-income analysis, ESG integration is generally focused on mitigating downside risk.
- A typical starting point for ESG integration is the identification of material qualitative and quantitative ESG factors that pertain to a company or its industry.

## REFERENCES

CFA Institute/Principles for Responsible Investment. 2018. *ESG Integration In The Americas: Markets, Practices, And Data*.

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## PRACTICE PROBLEMS

### The following information relates to Questions 1 and 2

Liz Kite is a research analyst for a global equity investment firm. She is conducting research on two publicly traded companies, Company A and Company B.

Company A has a large number of shareholders, with no single investor owning more than 5% of the outstanding shares. Company B is managed by a family who owns 60% of the outstanding shares. Both companies offer a single share class with equivalent voting rights.

- 1 **Determine** the relative level of risk (high or low) of principal–agent problems being present at each company. **Justify** your response.
- 2 **Discuss** drawbacks *most likely* associated with the ownership structure of Company B.
  
- 3 Clayton Streett is a consultant specializing in corporate governance issues. His current assignment is to evaluate the effectiveness of the board of Jess-Kait Worldwide. Streett seeks to determine if aspects of the company's corporate governance warrant a higher than average risk premium for the company's shares.

Jess-Kait Worldwide has a one-tier board structure, with the CEO serving as the chair of the board. Of the 20 board members, 8 are executive and 12 are non-executive (i.e., independent). The executive members primarily serve on the compliance and investment committees, while the non-executive members primarily serve on the audit, compensation, and board selection committees. The executive board members have all served on the board for more than 20 years, while the non-executive members' average tenure is only 5 years.

**Determine** which board considerations would *most likely* warrant a higher than average risk premium for the shares of Jess-Kait Worldwide. **Justify** each response.

- i. Structure
- ii. Independence
- iii. Committees
- iv. Composition

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**Determine which board considerations would *most likely* warrant a higher than average risk premium for the shares of Jess-Kait Worldwide. Justify each response.**

---

Board Consideration	Higher Risk Premium?	Justification
i) Structure	Yes	
	No	

---

**Determine which board considerations would *most likely* warrant a higher than average risk premium for the shares of Jess-Kait Worldwide. Justify each response.**

Board Consideration	Higher Risk Premium?	Justification
ii) Independence	Yes	
	No	
iii) Committees	Yes	
	No	
iv) Composition	Yes	
	No	

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## The following information relates to Questions 4 and 5

Chambers Carlisle was recently hired as an analyst for a fixed-income fund with a short-term investment horizon. Carlisle focuses on bonds in the materials sector and incorporates environmental, social, and governance (ESG) factors into his analysis. His previous employer was a buy-and-hold equity fund, where Carlisle included ESG factors in his analysis of equities in the materials sector.

- 4 Discuss** how Carlisle's ESG analysis in his new position *most likely* differs from that in his previous position.

Carlisle identifies the ESG risk factors that are relevant to companies in the materials sector. He conducts his research by reviewing public documents, such as company annual reports, regulatory filings, and proxy reports.

- 5 Discuss** the challenges *most likely* associated with Carlisle's research approach.
- 

## The following information relates to Questions 6 and 7

Dalanta Transportation operates a rail transportation business in the Southwest United States. Competition in the region for rail transport has intensified in the last few years, resulting in decreasing profit margins. Dalanta has received multiple warnings from state and federal regulators and faces potential fines for violating clean air regulations due to excessive greenhouse gas emissions (GHG) by the company's aging fleet of trains. As a result, the company has been the target of highly publicized criticism from environmental activist groups.

- 6 Discuss** the potential effects of environmental, social, and governance (ESG) factors on Dalanta's financial performance.

Dalanta's CEO hires a consultant to help the company address the ESG issues. The CEO had planned to issue a conventional bond to finance the replacement of the oldest half of the fleet of trains, but the consultant recommends that Dalanta issue a green bond to finance the purchase of new trains.

- 7** **Discuss *one* advantage and *one* disadvantage to Dalanta if the company follows the consultant's financing recommendation.**
-

## SOLUTIONS

**1 Risk of principal–agent problems:**

- Company A has dispersed ownership and dispersed voting power. This results in weak shareholders and strong managers, which suggests a high risk of principal–agent problems.
- Company B has concentrated ownership and concentrated voting power. This results in strong shareholders and weak managers, which suggests a low risk of principal–agent problems.

Company A has a large number of shareholders, with no single shareholder owning more than 5% of the outstanding shares. The combination of dispersed ownership and dispersed voting power is generally associated with shareholders who lack the power to exercise control over managers. These shareholders are referred to as weak shareholders, and such managers are referred to as strong managers. Under this combination, there is a high risk that managers will seek to utilize a company's resources to pursue their own interests rather than those of the shareholders. This conflict is known as a principal–agent problem.

Company B is managed by a family who owns a majority of the outstanding voting shares. One of the benefits of family control through concentrated ownership and management is a low risk of principal–agent problems. Family control can, however, lead to principal–principal problems as the rights of minority shareholders may receive only modest consideration.

**2 Drawbacks of Company B's ownership structure include the following:**

- Poor transparency
- Lack of management accountability
- Modest consideration for minority shareholder rights
- Difficulty in attracting quality talent for management positions

Company B is managed by a family who owns a majority of the outstanding voting shares. Drawbacks to family ownership may include poor transparency, lack of management accountability, modest consideration for minority shareholder rights, and difficulty in attracting quality talent for management positions.

**3**

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**Determine which board considerations would *most likely* warrant a higher than average risk premium for the shares of Jess-Kait Worldwide. Justify each response.**

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Board Consideration	Higher Risk Premium?	Justification
i) Structure	Yes	The structure of Jess-Kait's board is one-tier, with the CEO also serving as chair of the board. This CEO duality may raise concerns that the monitoring and oversight role of the board may be compromised. This negative attribute would likely warrant a higher than average risk premium.
	No	

*(continued)*

**Determine which board considerations would *most likely* warrant a higher than average risk premium for the shares of Jess-Kait Worldwide. Justify each response.**

Board Consideration	Higher Risk Premium?	Justification
ii) Independence	Yes	Jess-Kait's board is comprised of 20 members, 12 of whom are independent. Having a majority of the board members be independent is a positive attribute and likely would not warrant a higher than average risk premium.
	No	
iii) Committees	Yes	When evaluating a board's committees, Streett should assess whether the key governance committees, such as the audit, compensation, and board selection committees, are sufficiently independent. With the non-executive board members primarily serving on these three important committees, there appears to be sufficient independence. This positive attribute likely would not warrant a higher than average risk premium.
	No	
iv) Composition	Yes	The executive board members have all served on the board for at least 20 years, which is a long tenure for board members. Long-tenured board members could become controlling, self-serving, or resistant to the introduction of new practices or policies that may be beneficial to stakeholders. This situation is especially troubling due to the fact that the non-executive board members' average tenure is only 5 years. This negative attribute would likely warrant a higher than average risk premium.
	No	

- 4 The investment horizon for the fixed-income securities in his new position is short term in nature, while his prior position had a long-term investment horizon.

ESG integration in fixed-income analysis generally focuses on mitigating downside risks, while ESG integration in equity analysis also includes identifying potential opportunities.

When deciding what ESG factors to consider in their analysis, analysts must consider the investment horizon. Some ESG issues may affect a company's performance in the short term, while other issues may affect it more in the long term. An investor with a short-term investment horizon may find that longer-term issues have little impact on a security's valuation in the near term. Since Carlisle's new job focuses on short-term fixed income, he is likely more concerned with short-term ESG issues than long-term ESG issues. In his previous position, the buy-and-hold nature of the equity fund implies a long-term investment horizon, so Carlisle would likely have considered both short-term and long-term ESG issues.

Carlisle's current position is in fixed-income analysis, while his previous position was in equity analysis. From a risk/reward perspective, the use of ESG integration typically differs for equity and fixed-income analysis. In equity analysis,

ESG integration is used to both identify potential opportunities and mitigate downside risk, whereas in fixed-income analysis, ESG integration is generally focused only on mitigating downside risk.

**5 Challenges:**

- ESG information and metrics may be reported inconsistently by companies.
- ESG-related disclosures are voluntary for many companies, and the level of voluntary disclosure varies.

A primary challenge when integrating ESG factors into investment analysis is identifying and obtaining information that is relevant and useful. Carlisle's research approach involves reviewing public documents, such as company annual reports, regulatory filings, and proxy reports. A challenge he will face is that ESG information and metrics may be reported inconsistently by companies. Another challenge is that a number of ESG-related disclosures are voluntary for many companies, and the level of voluntary disclosure varies.

**6 Potential effects:**

- Increased costs to comply with regulatory requirements
- Potential fines for violating clean air regulations
- Damage to corporate reputation that could potentially decrease sales

Dalanta must address the clean air regulations. The costs to comply with these regulations could be significant, but the potential fines for failing to comply with these regulations could also be significant. These expenses would have a negative effect on Dalanta's financial performance. Finally, the company received highly publicized criticism from environmental activist groups. Such criticism could damage Dalanta's reputation and have a negative effect on sales, especially considering the increasingly competitive landscape for rail transport in the region.

**7 Advantages and disadvantages:**

Advantages:

- Green bonds can command a premium over comparable conventional bonds
- Lower cost of capital due to green bond premium

Disadvantages:

- Additional costs related to the monitoring and reporting of the use of the bond's proceeds
- Lack of liquidity of green bonds when purchased and held by buy-and-hold investors

Dalanta's financing of the new trains using green bonds may provide advantages compared to conventional bonds. Some green bonds can command a premium, or tighter credit spread, versus comparable conventional bonds due to market demand. This tighter credit spread could have a positive effect on Dalanta's cost of capital and valuation. However, issuing green bonds could result in Dalanta incurring additional costs related to the monitoring and reporting of the use of the bond's proceeds. In addition, liquidity risk is associated with green bonds that are purchased and held by buy-and-hold investors.



## READING

# 23

## Mergers and Acquisitions

by Rosita P. Chang, PhD, CFA, and Keith M. Moore, CFA

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### LEARNING OUTCOMES

<i>Mastery</i>	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. classify merger and acquisition (M&A) activities based on forms of integration and relatedness of business activities;
<input type="checkbox"/>	b. explain common motivations behind M&A activity;
<input type="checkbox"/>	c. explain bootstrapping of earnings per share (EPS) and calculate a company's post-merger EPS;
<input type="checkbox"/>	d. explain, based on industry life cycles, the relation between merger motivations and types of mergers;
<input type="checkbox"/>	e. contrast merger transaction characteristics by form of acquisition, method of payment, and attitude of target management;
<input type="checkbox"/>	f. distinguish among pre-offer and post-offer takeover defense mechanisms;
<input type="checkbox"/>	g. calculate and interpret the Herfindahl–Hirschman Index and evaluate the likelihood of an antitrust challenge for a given business combination;
<input type="checkbox"/>	h. compare the discounted cash flow, comparable company, and comparable transaction analyses for valuing a target company, including the advantages and disadvantages of each;
<input type="checkbox"/>	i. calculate free cash flows for a target company and estimate the company's intrinsic value based on discounted cash flow analysis;
<input type="checkbox"/>	j. estimate the value of a target company using comparable company and comparable transaction analyses;
<input type="checkbox"/>	k. evaluate a takeover bid and calculate the estimated post-acquisition value of an acquirer and the gains accrued to the target shareholders versus the acquirer shareholders;
<input type="checkbox"/>	l. explain how price and payment method affect the distribution of risks and benefits in M&A transactions;

(continued)

## LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	m. describe characteristics of M&A transactions that create value;
<input type="checkbox"/>	n. distinguish among equity carve-outs, spin-offs, split-offs, and liquidation;
<input type="checkbox"/>	o. explain common reasons for restructuring.

# 1

## INTRODUCTION

Companies enter into merger and acquisition activities for a variety of reasons. Many companies use mergers as a means to achieve growth. Others seek to diversify their businesses. In all cases, it is important for corporate executives and analysts to understand both the motives for mergers and their financial and operational consequences.

Merger and acquisition (M&A) activities involve a variety of complexities and risks. For the case described in Example 1, corporate managers, investors, regulators, and a bevy of advisers—including investment bankers, financial analysts, lawyers, and accountants—each evaluated the various offers from a variety of perspectives.

### EXAMPLE 1

#### Guidant–Boston Scientific Merger

On 15 December 2004, Guidant Corporation (GDT), a manufacturer of heart defibrillators and other specialized medical equipment, agreed to merge with Johnson & Johnson (JNJ), a large, multinational producer of medical products and equipment. Guidant shareholders were to receive \$30.40 in cash and \$45.60 in JNJ stock (subject to conditions) per share of Guidant stock held. Although a merger such as the combination between GDT and JNJ normally would take about four months to complete, unanticipated events caused the planned merger transaction to become a year-long saga.

While the companies worked to obtain the required regulatory clearances, a number of investigative articles exposing problems with GDT's defibrillators appeared in the *New York Times* in the spring of 2005. The company issued notices to physicians who prescribed the company's products warning them of potential problems with various defibrillator models. During the summer of 2005, GDT removed some defibrillators from the market as it tried to correct the technical problems. Meanwhile, numerous liability suits were filed against the company, and GDT subsequently lost a significant portion of its sales. Because of these negative developments, JNJ sought to renegotiate the terms of the transaction, claiming that the "material adverse change" clause in the merger agreement had been violated.<sup>1</sup>

GDT held that the loss of business did not violate the "material adverse change" clause. After initially filing a lawsuit in the US District Court in an attempt to force JNJ to adhere to the original agreement, GDT later decided to enter into negotiations with JNJ to see if the two companies could agree on an

<sup>1</sup> Many merger and acquisition agreements include provisions for renegotiation or cancellation following events that have a significant negative effect on the company's value or business operations.

acceptable modified agreement. In November 2005, the two companies agreed to modify the consideration that JNJ would pay GDT shareholders. In the new agreement, GDT shareholders were to receive \$33.25 in cash and 0.493 shares of JNJ stock for each share of GDT held. With JNJ stock trading at a price of about \$62.00 in November 2005, the total value of the deal to GDT shareholders was about \$63.82 per share of GDT held, which was a significantly lower merger price than in the original agreement.

Shortly after the modified merger agreement was announced, the chairman of another medical device manufacturer, Boston Scientific Corporation (BSX), contacted the chairman of GDT and indicated an interest in pursuing a business combination as an alternative to the JNJ merger. Because of the existing GDT–JNJ merger agreement, Guidant's legal advisers reminded the company's managers that they were prevented from entering into any competing merger discussions unless there was a merger proposal that could be deemed "superior" to the JNJ offer. As a result, on 5 December 2005, BSX communicated an offer to acquire GDT for \$36 in cash and \$36 in BSX common stock (subject to various conditions).

Although JNJ had fought for many months to acquire GDT at a reduced price, within a month, it improved the price it was willing to pay for GDT. A bidding war was under way. On 11 January 2006, JNJ's offer was for \$37.25 in cash and 0.493 shares of JNJ stock—an increase of \$4 in cash. The following day, BSX responded by increasing its offer to a total of \$73—\$36.50 in cash and \$36.50 in stock plus \$0.012 interest per day for every day after 1 April that the merger was not completed. By offering compensation for any delay past 1 April, BSX sought to reassure any shareholders who might otherwise decline the offer out of concerns that antitrust objections might delay completion of the merger.

JNJ responded the next day, on 13 January, by increasing its offer to \$40.52 in cash and 0.493 shares of JNJ stock. Although some believed that the auction was over, BSX was not done. On 15 January 2006, BSX increased its offer to \$42 in cash and \$38 in BSX stock for a total of \$80. The two companies entered into a definitive merger agreement, the agreement with JNJ was terminated, and the GDT–BSX merger was ultimately completed in April 2006.

Despite all the legal issues and product liability problems, a competitive bidding war resulted in a more lucrative merger consideration for Guidant shareholders, who ultimately received \$4.00 more than the original JNJ merger proposal.

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This reading will discuss many of the issues brought forth in Example 1, such as the forms of payment in a merger, legal and contractual issues, and the necessity for regulatory approval. More importantly, this reading aims to equip you with the basic tools for analyzing M&A deals and the companies behind them. In subsequent sections, we will discuss the motives behind business combinations, various transaction characteristics of M&A deals, the regulations governing M&A activity, and how to evaluate a target company and a proposed merger. Section 2 discusses the basic types of mergers. Section 3 examines the common motives that drive merger activities. In Section 4, we consider various transaction characteristics and their impact on different facets of M&A deals. Section 5 focuses on takeovers and the common defenses used to defeat unwelcome takeover attempts. In Section 6, we outline the various regulations that apply to M&A activity. Section 7 explores methods for analyzing a target company and provides a framework for analyzing merger bids. In Section 8, we review the empirical evidence related to the distribution of gains in mergers. Section 9 provides a brief introduction to corporate restructuring activities, and we conclude the reading with a summary.

**2**

## MERGERS AND ACQUISITIONS: DEFINITIONS AND CLASSIFICATIONS

Business combinations come in different forms. A distinction can be made between acquisitions and mergers. In the context of M&A, an **acquisition** is the purchase of some portion of one company by another. An acquisition might refer to the purchase of assets from another company, the purchase of a definable segment of another entity, such as a subsidiary, or the purchase of an entire company, in which case the acquisition would be known as a merger. A **merger** represents the absorption of one company by another. That is, one of the companies remains and the other ceases to exist as a separate entity. Typically, the smaller of the two entities is merged into the larger, but that is not always the case.

Mergers can be classified by the form of integration. In a **statutory merger**, one of the companies ceases to exist as an identifiable entity and all its assets and liabilities become part of the purchasing company. In a **subsidiary merger**, the company being purchased becomes a subsidiary of the purchaser, which is often done in cases where the company being purchased has a strong brand or good image among consumers that the acquiring company wants to retain. A **consolidation** is similar to a statutory merger except that in a consolidation, *both* companies terminate their previous legal existence and become part of a newly formed company. A consolidation is common in mergers where both companies are approximately the same size.

The parties to a merger are often identified as the target company and the acquiring company. The company that is being acquired is the **target company**, or simply the **target**. The company acquiring the target is called the **acquiring company**, or the **acquirer**. We will use this terminology throughout the reading.

In practice, many of the terms used to describe various types of transactions are used loosely such that the distinctions between them are blurred. For example, the term “consolidation” is often applied to transactions where the entities are about the same size, even if the transaction is technically a statutory merger. Similarly, mergers are often described more generally as **takeovers**, although that term is often reserved to describe **hostile transactions**, which are attempts to acquire a company against the wishes of its managers and board of directors. A **friendly transaction**, in contrast, describes a potential business combination that is endorsed by the managers of both companies, although that is certainly no guarantee that the merger will ultimately occur.

An additional way that mergers are classified is based on the relatedness of the merging companies’ business activities. Considered this way, there are three basic types of mergers: horizontal, vertical, and conglomerate.

A **horizontal merger** is one in which the merging companies are in the same kind of business, usually as competitors. The Vodafone AirTouch acquisition of telecommunications competitor Mannesmann AG in 2000 is one example of a horizontal merger. Another example is the merger of Mobil and Exxon in 1999. One of the great motivators behind horizontal mergers is the pursuit of **economies of scale**, which are savings achieved through the consolidation of operations and elimination of duplicate resources. Another common reason for horizontal mergers is to increase market power, because the merger results in a reduction of the number of industry competitors and an increase in the size of the acquiring company.

In a **vertical merger**, the acquirer buys another company in the same production chain, for example, a supplier or a distributor. In addition to cost savings, a vertical merger may provide greater control over the production process in terms of quality or procurement of resources or greater control over the distribution of the acquirer’s finished goods. If the acquirer purchases a target that is ahead of it in the value chain (a supplier), it is called **backward integration**. An example of backward integration is if a steel manufacturer purchases an iron ore mining company. When an acquirer

purchases a company that is further down the value chain (a distributor), it is called **forward integration**. An example of forward integration is Merck & Co.'s 1993 acquisition of Medco Containment Services, a marketer of discount prescription medicines. The merger brought together the production and distribution of pharmaceuticals into one integrated company.

When an acquirer purchases another company that is unrelated to its core business, it may be called a **conglomerate merger**. General Electric is an example of a conglomerate, having purchased companies in a wide range of industries, including media, finance, home appliances, aircraft parts, and medical equipment. Conglomerate mergers were particularly popular from the 1960s through the 1980s. The concept of company-level diversification was commonly used as a rationale for inter-industry mergers during this period. By investing in companies from a variety of industries, companies hoped to reduce the volatility of the conglomerate's total cash flows. As we will discuss in the section on merger motivations, company-level diversification is not necessarily in the shareholders' best interests.

## EXAMPLE 2

### History of US Merger Activity

The history of merger activity in the United States illustrates the various types of M&A combinations. Merger and acquisition activities have historically been clustered in waves. The predominant types of mergers and the structures of merger deals have varied with each wave, typically as a result of differences in the regulatory environment. Similarly, the industries involved tend to vary by wave. Merger activity is apt to be concentrated in a relatively small number of industries, usually those going through dramatic changes, such as deregulation or rapid technological advancement.

#### First Wave (1897–1904)

At the close of the 1800s, growth in the railroads linked regional markets and created an environment conducive to larger companies that could capitalize on the emerging national US economy, particularly within the mining and manufacturing industries. A relatively lax regulatory environment contributed to the situation, and many horizontal mergers resulted in near monopolistic conditions in several industries. The wave ended in 1904 as a result of a landmark decision by the US Supreme Court limiting horizontal mergers among large competitors.

#### Second Wave (1916–1929)

In the 1920s, motor vehicles and radio coupled with improved railroad infrastructure further bolstered the US economy. Like the previous wave, the second wave was accompanied by a sharp increase in stock prices. This time, however, the regulatory environment was less friendly to horizontal combinations and more sensitive to market power. Because market power was already concentrated among a few companies and further horizontal integration was difficult, companies sought to integrate backward into supply and forward into distribution through vertical mergers. Consequently, business combinations in this wave tended to create oligopolies. This second wave came to a conclusion with the 1929 stock market crash.

#### Third Wave (1965–1969)

The third wave occurred in a regulatory environment that strongly discouraged any merger—horizontal or vertical—that would reduce competition within an industry. Companies seeking to expand thus looked outside their own industries

and began forming conglomerates. Many of the conglomerates created during this period subsequently underperformed the market. The third merger wave ended in 1969 as antitrust enforcement curtailed the rise of conglomerates.

### Fourth Wave (1981–1989)

The regulatory environment in the 1980s was friendlier to both horizontal and vertical mergers than it had been in the 1960s, but what really fueled business combinations during this period was the development of the high-yield bond market, which benefited as falling interest rates and rising stock prices created an environment conducive to the greater use of leverage.

Although hostile takeovers were nothing new, increased ability to tap the high-yield bond market put the capacity to finance a takeover in the hands of people and companies that otherwise might not have had access to the necessary capital. This period was marked by the rise of the corporate raider and increasingly sophisticated takeover attempts (and defenses). A **corporate raider** is a person or organization seeking to profit by acquiring a company and reselling it.<sup>2</sup> As the 1980s came to a close, the stock market and economy softened, bringing the fourth wave to its conclusion.

### Fifth Wave (1992–2001)

Following the 1990–91 recession, merger activity increased in 1992 and intensified throughout the decade. A strong and long-running bull market created many companies with high market valuations, which were then more easily able to use their equity to purchase other companies; thus, stock-swap mergers became more common during this wave. Additionally, during the latter half of the 1990s, US regulators were more open to industry consolidation as merger waves in Europe and Asia created larger international competitors. Deregulation and technological advancement further fueled merger activity, particularly in banking, health care, defense, and telecommunications. The fifth wave ended with a dramatic decline in transactions in 2001 as the market and the economy waned following the end of the internet bubble of the late 1990s.

### Sixth Wave (2003–Present)

Based on M&A industry statistics, such as M&A deal volume, it appears that we are in the midst of a sixth wave that began in 2003. After a sharp decline in the number of M&A deals directly following the conclusion of the fifth wave in 2001, the market began to pick up again in 2003 and strengthened rapidly through 2004. The number of transactions increased again in 2005 and surpassed the transaction volume records set at the height of the internet bubble to reach a new all-time high. As in the fifth wave, there has been much industry consolidation in the sixth wave, which is producing larger companies that are better able to compete globally.

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<sup>2</sup> As we will point out later in the section on takeover defenses, in some circumstances a corporate raider can profit from an unsuccessful takeover attempt. It was common during this merger wave for companies to pay raiders a premium in exchange for the raider terminating the attempted takeover, a tactic commonly referred to as “greenmail.” Indeed, many raiders initiated takeover attempts without expecting to complete the acquisition.

## MOTIVES FOR MERGER

3

In the previous section, we mentioned some of the basic motives behind mergers, such as the search for economies of scale (in a horizontal merger) or cost savings through integration (in a vertical merger). In this section, we will expand on this topic and survey some of the reasons companies merge—the motives or rationales for merger.

The topic is important because in assessing a proposed combination, investors and analysts need to carefully evaluate the rationale behind the merger. Does the stated rationale make sense? Is the merger likely to create value? What is the probability that each of the stated goals for the merger will be attained? Keep in mind that many motives are interrelated and that there are typically several motives, both acknowledged and tacit, behind any given merger.

### 3.1 Synergy

Among the most common motivations for a merger is the creation of synergy, in which the whole of the combined company will be worth more than the sum of its parts. Generally speaking, synergies created through a merger will either reduce costs or enhance revenues. Cost synergies are typically achieved through economies of scale in research and development, procurement, manufacturing, sales and marketing, distribution, and administration. Revenue synergies are created through the cross-selling of products, expanded market share, or higher prices arising from reduced competition. For example, a bank that acquires its competitors can both increase its market share and realize operating efficiencies by closing duplicate branches and integrating back-office operations.

### 3.2 Growth

Corporate managers are under constant pressure to grow their companies' revenues, and they often turn to M&A activity to achieve that growth. Companies can grow either by making investments internally (i.e., **organic growth**) or by buying the necessary resources externally (i.e., **external growth**). It is typically faster for companies to grow externally. Growth through M&A activity is common when a company is in a mature industry. For example, the global oil industry is a mature industry, and BP, ExxonMobil, and Chevron Corporation have increased their reserves and output by acquiring smaller competitors.

External growth can also mitigate risk. It is considered less risky to merge with an existing company than to enter an unfamiliar market and establish the resources internally. The last several years of the fifth merger wave in the 1990s were characterized by a surge in cross-border M&A transactions, many of which were motivated by the desire to establish footholds in international markets.

### 3.3 Increasing Market Power

In industries where there are few competitors or where market share is sufficiently concentrated, horizontal integration may be a means by which to increase market power. When a company increases its market power through horizontal mergers, it may have a greater ability to influence market prices. Taken to an extreme, horizontal integration results in a monopoly.

Vertical integration may also result in increased market power. Vertical mergers can lock in a company's sources of critical supplies or create captive markets for its products. Imagine, for example, an industry in which one company supplies raw materials to two separate manufacturing companies. If one of the manufacturers were

to acquire the raw materials provider, the acquirer would be in a position to influence industry output and ultimately prices. As we will discuss further in the section on antitrust regulation, government regulators routinely block both horizontal and vertical mergers that sufficiently reduce competition in an industry and concentrate market power in the hands of too few companies.

### 3.4 Acquiring Unique Capabilities and Resources

Many companies undertake a merger or an acquisition either to pursue competitive advantages or to shore up lacking resources. When a company cannot cost-effectively create internally the capabilities needed to sustain its future success, it may seek to acquire them elsewhere. For example, a company may engage in M&A activity in order to acquire specific competencies or resources it lacks, such as a strong research department, nimble sales force, intellectual capital, or creative talent.

### 3.5 Diversification

Companies sometimes cite diversification as one of the motives behind a merger. Indeed, this was an especially popular motive for conglomerates during the third merger wave. The idea behind company-level diversification is that the company can be treated as a portfolio of investments in other companies. If a conglomerate invests in companies from a variety of industries, then the variability of the conglomerate's total cash flows should be reduced, at least to the extent that the industries are uncorrelated.

Although this may seem like a rational motive, typically, it is not in the best interests of the conglomerate's shareholders. In a well-functioning capital market, investors can diversify their own portfolios more easily and at less expense. Additionally, the desire to diversify has led some companies to lose sight of their major competitive strengths and to expand into businesses where they lack comparative advantages.

### 3.6 Bootstrapping Earnings

Even when there are no reasons to believe that synergies or growth would result from a merger, it is possible to create the illusion of synergies or growth. When a company's earnings increase as a consequence of the merger transaction itself (rather than because of resulting economic benefits of the combination), it is referred to as the "bootstrap effect" or "bootstrapping earnings." The bootstrap effect occurs when the shares of the acquirer trade at a higher price–earnings ratio (P/E) than those of the target and the acquirer's P/E does not decline following the merger.

#### EXAMPLE 3

##### Bootstrapping Earnings

Assume two companies are planning a merger. Company A is the acquirer, Company T is the target, and Company A\* is the post-merger combination of the two companies. The companies' stock prices and earnings per share are as shown below. Note that the acquirer has a P/E of 25.0 and the target has a P/E of 20.0:

	A	T	A*
Stock price	\$100.00	\$50.00	
EPS	\$4.00	\$2.50	\$4.20
P/E	25.0	20.0	

	A	T	A*
Total shares outstanding	100,000	50,000	125,000
Total earnings	\$400,000	\$125,000	\$525,000
Market value of equity	\$10,000,000	\$2,500,000	

Given its stock price, the acquirer can issue 25,000 of its own shares and use the proceeds to buy the target company. This amount is determined by dividing the target's market value by the acquirer's stock price ( $\$2,500,000/\$100 = 25,000$ ). The total shares outstanding of the merged company will be 125,000—the acquirer's initial 100,000 shares plus the 25,000 shares that the acquirer issued to purchase the target. After the merger, the company's combined earnings are divided by the number of shares outstanding to determine the new EPS ( $\$525,000/125,000 = \$4.20$ ), which is \$0.20 higher per share than the acquirer would have reported without the merger.

If the acquirer's pre-merger stock price had been \$80 instead of \$100, then A's pre-merger P/E would have been 20.0 ( $\$80/\$4.00$ ). Under that scenario, the acquirer would have issued 31,250 shares to purchase the target. The EPS of the merged company would then have been  $\$525,000/31,250 = \$4.00$ , thus illustrating that for bootstrapping to work, the acquirer's P/E must be higher than the target's P/E.

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If the market is efficient, the post-merger P/E should adjust to the weighted average of the two companies' contributions to the merged company's earnings. In the previous example, the P/E of the merged company would be about 23.8, which implies that the acquirer's stock price would remain at \$100. If, however, the acquiring company's P/E is higher than the target's and management can convince investors to value the merged company using the acquirer's pre-merger P/E, then the stock price of the new company should rise. If the acquirer bootstraps earnings to \$4.20 per share as shown in the example above, then the share price should increase to \$105 if investors apply the pre-merger P/E of 25.0 times earnings ( $\$4.20 \times 25.0 = \$105$ ). When there are no expected gains from synergy or other factors, such share price increases are not expected.

The market usually recognizes the bootstrapping effect, and post-merger P/Es adjust accordingly. But there have been periods when bootstrapping seemed to pay off for managers, at least in the short run. During the third merger wave, many conglomerates benefited from bootstrapping as investors grappled with how to value these diversified corporate behemoths. Likewise, during the internet bubble of the late 1990s, many high P/E companies bootstrapped their earnings and showed continuous EPS growth through a constant string of mergers with lower P/E companies.

### 3.7 Managers' Personal Incentives

Various managerial-related theories for mergers have been developed over the years based on evidence of agency problems. **Managerialism theories** posit that because executive compensation is highly correlated with company size, corporate executives are motivated to engage in mergers to maximize the size of their company rather than shareholder value. Additionally, corporate executives may be motivated by self-aggrandizement. For example, being the senior executive of a large company conveys greater power and more prestige.

### 3.8 Tax Considerations

It is possible for a profitable acquirer to benefit from merging with a target that has accumulated a large amount of tax losses. Instead of carrying the tax losses forward, the merged company would use the tax losses to immediately lower its tax liability. In many countries, the taxing authority disallows an offset in cases where the primary reason for the merger is tax avoidance. Mergers are typically conducted for a variety of reasons, however, and it is difficult for regulatory authorities to prove that tax considerations are a primary motivator.

### 3.9 Unlocking Hidden Value

A potential target company may be uncompetitive over a sustained period for a host of reasons, including poor management, lack of resources, high legacy costs, or poor organizational structure. In those instances, when a potential target is underperforming, an acquirer may believe it can acquire the company cheaply and then unlock hidden value through reorganization, better management, or synergy. If the target has been underperforming significantly, the acquirer may even believe it can obtain the company for less than its breakup value. A company's **breakup value** is the value that can be achieved if a company's assets are divided and sold separately.

Sometimes mergers are conducted because the acquirer believes that it is purchasing assets for below their replacement cost. For example, a pharmaceutical company may believe it can acquire another company's research more cheaply than to undergo a lengthy development process of its own. Or, an oil company may believe it will be less expensive to acquire another oil company's assets than to find and develop additional reserves of its own.

### 3.10 Cross-Border Motivations

The growth of cross-border deals was high during the 1990s, and foreign M&A became a popular strategic tool for multinational companies seeking to extend their market reach, acquire new manufacturing facilities, develop new sources of raw materials, and tap into the capital markets. Given the increasing international privatization trends, reduction in cumbersome industry regulations and bureaucracy, and development of uniform accounting standards, cross-border mergers and acquisitions will likely intensify in the future. In addition to the various factors that drive domestic mergers, cross-border mergers can provide an efficient way of achieving other international business goals.

#### 3.10.1 Exploiting Market Imperfections

Cross-border transactions can enable companies to more fully exploit market imperfections. For example, to take advantage of differences in the relative cost of labor, a manufacturer may purchase a company in a country where the relative cost of labor is lower.

#### 3.10.2 Overcoming Adverse Government Policy

Cross-border mergers can be a means by which to overcome disadvantageous government policy, for example, to circumvent protective tariffs, quotas, or other barriers to free trade.

**3.10.3 Technology Transfer**

Companies that possess a new or superior technology may make acquisitions abroad in order to open new markets or otherwise more fully exploit their business advantage. Conversely, it is common for a company to purchase a foreign company that possesses a new or superior technology in order to enhance the acquirer's competitive position both at home and abroad.

**3.10.4 Product Differentiation**

Companies often purchase foreign companies to exploit the advantages of having a highly differentiated line of products. Similarly, buying certain intangibles, such as a good reputation, helps to ensure success in the global market. Lenovo's (China) acquisition of IBM's (United States) personal computer line is one example of this strategy.

**3.10.5 Following Clients**

Companies may engage in a cross-border merger to follow and support domestic clients more effectively. As an example, many German banks have established cross-border presences to provide services abroad to their domestic clients.

**EXAMPLE 4****Mergers and the Industry Life Cycle**

The types of mergers (e.g., horizontal, vertical, or conglomerate) occurring in an industry and the motivations behind those mergers will vary over time as an industry proceeds through its life cycle. The stages in an industry life cycle are normally categorized by their rates of growth in sales; growth stages can vary in length.

**Mergers and Industry Life Cycles**

<b>Industry Life Cycle Stage</b>	<b>Industry Description</b>	<b>Motives for Merger</b>	<b>Types of Mergers</b>
Pioneering development	■ Industry exhibits substantial development costs and has low, but slowly increasing, sales growth.	■ Younger, smaller companies may sell themselves to larger companies in mature or declining industries and look for ways to enter into a new growth industry. ■ Young companies may look to merge with companies that allow them to pool management and capital resources.	■ Conglomerate ■ Horizontal
Rapid accelerating growth	■ Industry exhibits high profit margins caused by few participants in the market.	■ Explosive growth in sales may require large capital requirements to expand existing capacity.	■ Conglomerate ■ Horizontal
Mature growth	■ Industry experiences a drop in the entry of new competitors, but growth potential remains.	■ Mergers may be undertaken to achieve economies of scale, savings, and operational efficiencies.	■ Horizontal ■ Vertical

*(continued)*

(Continued)

Industry Life Cycle Stage	Industry Description	Motives for Merger	Types of Mergers
Stabilization and market maturity	■ Industry faces increasing competition and capacity constraints.	■ Mergers may be undertaken to achieve economies of scale in research, production, and marketing to match the low cost and price performance of other companies (domestic and foreign). ■ Large companies may acquire smaller companies to improve management and provide a broader financial base.	■ Horizontal
Deceleration of growth and decline	■ Industry faces overcapacity and eroding profit margins.	■ Horizontal mergers may be undertaken to ensure survival. ■ Vertical mergers may be carried out to increase efficiency and profit margins. ■ Companies in related industries may merge to exploit synergy. ■ Companies in this industry may acquire companies in young industries.	■ Horizontal ■ Vertical ■ Conglomerate

Source: Adapted from J. Fred Weston, Kwang S. Chung, and Susan E. Hoag, *Mergers, Restructuring, and Corporate Control* (New York: Prentice Hall, 1990, p. 102) and Bruno Solnik and Dennis McLeavey, *International Investments*, 5th edition (Boston: Addison Wesley, 2004, pp. 264–265).

## 4

## TRANSACTION CHARACTERISTICS

The specifics of M&A transactions can vary along many dimensions, including the form of acquisition, financing, timing, control and governance, accounting choices, and numerous details ranging from the post-merger board composition to the location of the new headquarters. In this section, we will focus on the form of acquisition, method of payment, and mind-set of target management. These three characteristics play a large role in determining how the transaction will occur, which regulatory rules might apply, how the transaction will be valued, and how it will be taxed.

### 4.1 Form of Acquisition

There are two basic forms of acquisition: An acquirer can purchase the target's stock or its assets. The decision will have several consequences, as summarized in Exhibit 1.

Stock purchases are the most common form of acquisition. A **stock purchase** occurs when the acquirer gives the target company's shareholders some combination of cash and securities in exchange for shares of the target company's stock. For a stock purchase to proceed, it must be approved by at least 50 percent of the target company's shareholders and sometimes more depending on the legal jurisdiction.

Although it can be difficult and time consuming to win shareholder approval, it also stands as an opportunity to circumvent the target company's management in cases where management opposes the merger.

In an **asset purchase**, the acquirer purchases the target company's assets and payment is made directly to the target company. One advantage of this type of transaction is that it can be conducted more quickly and easily than a stock purchase because shareholder approval is not normally required unless a substantial proportion of the assets are being sold, usually more than 50 percent. Another advantage is that an acquirer can focus on buying the parts of a company of particular interest, such as a specific division, rather than the entire company.

#### Exhibit 1 Major Differences of Stock versus Asset Purchases

	Stock Purchase	Asset Purchase
Payment	Target shareholders receive compensation in exchange for their shares.	Payment is made to the selling company rather than directly to the shareholders.
Approval	Shareholder approval required.	Shareholder approval might not be required.
Tax: Corporate	No corporate-level taxes.	Target company pays taxes on any capital gains.
Tax: Shareholder	Target company's shareholders are taxed on their capital gain.	No direct tax consequence for target company's shareholders.
Liabilities	Acquirer assumes the target's liabilities.	Acquirer generally avoids the assumption of liabilities.

Some of the more dramatic consequences of the decision to pursue one form of acquisition versus another concern taxation. In a stock purchase, the target company's shareholders exchange their shares for compensation and must pay tax on their gains, but there are no tax consequences at the corporate level.<sup>3</sup> For an asset purchase, in contrast, there are no direct tax consequences for the target company's shareholders, but the target company itself may be subject to corporate taxes.

In addition to shifting the basic tax burden, the form-of-acquisition decision plays a role in determining how tax rules are applied in accounting for the merger. For example, use of a target's accumulated tax losses is allowable in the United States for stock purchases, but not for asset purchases.

Another key difference between stock and asset purchases relates to the assumption of liabilities. In stock purchases, the acquiring company assumes the target company's liabilities. Acquiring companies must thus be on guard to avoid assuming unexpected or undisclosed liabilities. With asset purchases, acquiring companies generally avoid assuming the target's liabilities. However, purchasing substantially all of a company's assets instead of conducting a stock purchase so as to specifically avoid assuming liabilities is fraught with legal risk because courts have tended to hold acquirers responsible for the liabilities in these cases.

<sup>3</sup> Keep in mind throughout this discussion of taxation that we are speaking in generalities and that the complexity of M&A deals, coupled with the complexity and variability of tax laws in different jurisdictions, can generate a host of exceptions.

## 4.2 Method of Payment

The acquirer can pay for the merger with cash, securities, or some combination of the two in what is called a **mixed offering**. In a **cash offering**, the cash might come from the acquiring company's existing assets or from a debt issue. In the most general case of a **securities offering**, the target shareholders receive shares of the acquirer's common stock as compensation.<sup>4</sup> Instead of common stock, however, the acquirer might offer other securities, such as preferred shares or even debt securities.

In a stock offering, the **exchange ratio** determines the number of shares that stockholders in the target company receive in exchange for each of their shares in the target company. Because share prices are constantly fluctuating, exchange ratios are typically negotiated in advance for a range of stock prices. The acquirer's cost is the product of the exchange ratio, the number of outstanding shares of the target company, and the value of the stock given to target shareholders. Each shareholder of the target company receives new shares based on the number of target shares he or she owns multiplied by the exchange ratio.

### EXAMPLE 5

#### Stock Offering

Discount Books, a Canadian bookseller, has announced its intended acquisition of Premier Marketing Corporation, a small marketing company specializing in print media. In a press release, Discount Books outlines the terms of the merger, which specify that Premier Marketing's shareholders will each receive 0.90 shares of Discount Books for every share of Premier Marketing owned. Premier Marketing has 1 million shares outstanding. On the day of the merger announcement, Discount Books' stock closed at C\$20.00 and Premier Marketing's stock closed at C\$15.00. Catherine Willis is an individual investor who owns 500 shares of Premier Marketing, currently worth C\$7,500 ( $500 \times C\$15.00$ ).

- 1 Based on the current share prices, what is the cost of the acquisition for Discount Books?
- 2 How many shares of Discount Books will Catherine Willis receive, and what is the value of those shares (based on current share prices)?

#### Solution to 1:

Because there are 1 million shares of Premier Marketing outstanding and the exchange ratio is 0.90 shares, Discount Books will need to issue  $0.90 \times 1\text{ million} = 900,000$  shares of Discount Books stock to complete the transaction. Because the cost per share of Discount Books stock is currently C\$20.00, the cost of the transaction to Discount Books will be  $C\$20.00 \times 900,000 = C\$18$  million.

#### Solution to 2:

Catherine Willis will turn over her 500 shares of Premier Marketing stock. As compensation, she will receive  $0.90 \times 500 = 450$  shares of stock in Discount Books. With each share of Discount Books being worth C\$20.00, the value of those shares to Catherine is C\$9,000.

Note that the value of Willis's Premier Marketing shares was C\$7,500. The C\$1,500 difference in value is a premium paid by Discount Books for control of Premier Marketing. The pre-merger value of Premier Marketing was C\$15 million,

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<sup>4</sup> In the case of a consolidation, the target company's shareholders may receive new shares in the surviving entity.

but Discount Books' total cost to purchase the company was C\$18 million. The 20 percent or C\$3 million difference is the total-control premium paid by Discount Books.

A variety of factors influence a company's decision to negotiate for one method of payment versus another. As we shall explore in more detail later, the form of payment has an impact on the distribution of risk and reward between acquirer and target shareholders. In a stock offering, target company shareholders assume a portion of the reward as well as a portion of the risk related to the estimated synergies and the target company's value. Consequently, when an acquiring company's management is highly confident both in their ability to complete the merger and in the value to be created by the merger, they are more inclined to negotiate for a cash offering rather than a stock offering.

Another factor in the decision relates to the relative valuations of the companies involved in the transaction. When an acquirer's shares are considered overvalued by the market relative to the target company's shares, stock financing is more appropriate. In effect, the shares are more valuable as a currency. In fact, investors sometimes interpret an acquirer's stock offering as a signal that the company's shares may be overvalued. This effect is similar to the negative market reaction observed in seasoned equity offerings. Indeed, during the stock market bubble in the late 1990s, stock financing of mergers was quite popular.

Another important consideration when deciding on the payment method is the accompanying change in capital structure. The costs and benefits of different payment structures reflect how the offer will affect the acquirer's capital structure. For instance, on the one hand, borrowing to raise funds for a cash offering increases the acquirer's financial leverage and risk. On the other hand, issuing a significant number of new common shares for a stock offering can dilute the ownership interests of existing shareholders.

Preferences in the use of cash versus stock vary over time, but the proportions in 2005 are characteristic of the past several years. According to *Mergerstat Review 2006*, cash payment accounted for 54 percent of merger transactions in 2005, pure stock exchanges accounted for about 19 percent, and mixed offerings represented 25 percent.<sup>5</sup> A very small portion of deals, about 2 percent, were completed with other securities, such as debt, options, or warrants.

### 4.3 Mind-Set of Target Management

Mergers are referred to as either friendly or hostile depending on how the target company's senior managers and board of directors view the offer. The distinction is not trivial because an enormous amount of time and resources can be expended by both acquirer and target when the takeover is hostile. Whether a merger is friendly or hostile has an impact on how it is completed, what regulations must be followed, how long the transaction takes, and possibly how much value is created (or destroyed) as a result of the combination.

#### 4.3.1 Friendly Mergers

Unless there is cause to think the target will be hostile to a merger, the acquirer will generally start the process by approaching target management directly. The target could approach the acquirer, although this method is much less common. If both management teams are amenable to a potential deal, then the two companies enter

<sup>5</sup> *Mergerstat Review 2006*. FactSet Mergerstat, LLC ([www.mergerstat.com](http://www.mergerstat.com)).

into merger discussions. The negotiations revolve around the consideration to be received by the target company's shareholders and the terms of the transaction as well as other aspects, such as the post-merger management structure.

Before negotiations can culminate in a formal deal, each of the parties examines the others' books and records in a process called due diligence. The purpose of due diligence is to protect the companies' respective shareholders by attempting to confirm the accuracy of representations made during negotiations. For example, an acquirer would want to ensure that the target's assets exist and are worth approximately what was claimed by the target. Likewise, a target might want to examine an acquirer's financial records to gauge the likelihood that the acquirer has the capacity to pay for the acquisition as outlined in negotiations. Any deficiencies or problems uncovered during the due diligence process could have an impact on negotiations, resulting in adjustments to the terms or price of the deal. If the issue is large enough, the business combination might be called off entirely.

Once due diligence and negotiations have been completed, the companies enter into a definitive merger agreement. The **definitive merger agreement** is a contract written by both companies' attorneys and is ultimately signed by each party to the transaction. The agreement contains the details of the transaction, including the terms, warranties, conditions, termination details, and the rights of all parties.

Common industry practice has evolved such that companies typically discuss potential transactions in private and maintain secrecy until the definitive merger agreement is reached. This trend may have been influenced by shifts in securities laws toward more stringent rules related to the disclosure of material developments to the public. Additionally, news of a merger can cause dramatic changes in the stock prices of the parties to the transaction. Premature announcement of a deal can cause volatile swings in the stock prices of the companies as they proceed through negotiations.

After the definitive merger agreement has been signed, the transaction is generally announced to the public through a joint press release by the companies. In a friendly merger, the target company's management endorses the merger and recommends that its stockholders approve the transaction. In cases where a shareholder vote is needed, whether it is the target shareholders approving the stock purchase or the acquirer shareholders approving the issuance of a significant number of new shares, the material facts are provided to the appropriate shareholders in a public document called a **proxy statement**, which is given to shareholders in anticipation of their vote.

After all the necessary approvals have been obtained—from shareholders as well as any other parties, such as regulatory bodies—the attorneys file the required documentation with securities regulators and the merger is officially completed. Target shareholders receive the consideration agreed upon under the terms of the transaction, and the companies are officially and legally combined.

#### 4.3.2 Hostile Mergers

In a hostile merger, which is a merger that is opposed by the target company's management, the acquirer may decide to circumvent the target management's objections by submitting a merger proposal directly to the target company's board of directors and bypassing the CEO. This tactic is known as a **bear hug**.

Because bear hugs are not formal offers and have not been mutually agreed upon, there are no standard procedures in these cases. If the offer is high enough to warrant serious consideration, then the board may appoint a special committee to negotiate a sale of the target.

Although unlikely in practice, it is possible that target management will capitulate after a bear hug and enter into negotiations, which may ultimately lead to a friendly merger. If the bear hug is not successful, then the hopeful acquirer will attempt to appeal more directly to the target company's shareholders.

One method for taking a merger appeal directly to shareholders is through a **tender offer**, whereby the acquirer invites target shareholders to submit (“tender”) their shares in return for the proposed payment.<sup>6</sup> It is up to the individual shareholders to physically tender shares to the acquiring company’s agent in order to receive payment. A tender offer can be made with cash, shares of the acquirer’s own stock, other securities, or some combination of securities and cash. Because a cash tender offer can be completed in less time than a cash merger, some acquiring companies use this type of transaction to gain control of a target company quickly.

Another method of taking over a target company involves the use of a proxy fight. In a **proxy fight**, a company or individual seeks to take control of a company through a shareholder vote. Proxy solicitation is approved by regulators and then mailed directly to target company shareholders. The shareholders are asked to vote for the acquirer’s proposed slate of directors. If the acquirer’s slate is elected to the target’s board, then it is able to replace the target company’s management. At this point, the transaction may evolve into a friendly merger.

Regardless of how an acquirer seeks to establish control, target managers have a variety of alternatives available for defending the company against unwanted overtures. In these cases, the target usually retains the services of law firms and investment bankers to design a defense against the unwanted takeover attempt. As we will discuss in the next section, target company managers may use a variety of legal and financial defensive maneuvers to ward off a takeover attempt.

## TAKEOVERS

5

When a target company is faced with a hostile tender offer (takeover) attempt, the target managers and board of directors face a basic choice. They can decide to negotiate and sell the company, either to the hostile bidder or a third party, or they can attempt to remain independent. Aside from the strength of the company’s defenses and target management’s resolve to stay independent, the premium over the market price offered by the acquirer for the target company’s shares is the major driving factor in the decision to support or resist any given takeover.

If the target management decides to resist the unwanted overture, they have a variety of takeover defense mechanisms at their disposal. Once the decision has been reached, the target company generally seeks the counsel of investment bankers and lawyers to explore the fairness of the hostile offer and to advise the board of the alternatives.

A target might use defensive measures to delay, negotiate a better deal for shareholders, or attempt to keep the company independent. Defensive measures can be implemented either before or after a takeover attempt has begun. Most law firms specializing in takeovers recommend that defenses be set up before a company receives or expects any takeover activity.

### 5.1 Pre-Offer Takeover Defense Mechanisms

In the United States, most hostile takeover attempts result in litigation. The courts generally bless legal pre-offer defense mechanisms but tend to scrutinize post-offer defenses very closely. The target usually assumes the burden of proof in showing that the recently enacted defenses are not simply intended to perpetuate management’s

<sup>6</sup> Tender offers are often associated with hostile mergers, but they also occur in a friendly context. Tender offers are considered hostile only when the offer is opposed by the target company’s management and board of directors.

tenure at the target company. It is for this reason that most attorneys recommend that target companies put defenses in place prior to any takeover action. Following this policy gives the target more flexibility when defending against a takeover bid.

With different twists in takeover strategy come new innovations and variations in takeover defenses. Given the many possible variations, the following is not an exhaustive list but an overview of the more well known anti-takeover strategies. The two broad varieties of pre-offer defenses are rights-based defenses, such as poison pills and poison puts, and a variety of changes to the corporate charter (e.g., staggered boards of directors and supermajority provisions) that are sometimes collectively referred to as **shark repellents**.

### 5.1.1 *Poison Pills*

The **poison pill** is a legal device that makes it prohibitively costly for an acquirer to take control of a target without the prior approval of the target's board of directors. Most poison pills make the target company less attractive by creating rights that allow for the issuance of shares of the target company's stock at a substantial discount to market value.

There are two basic types of poison pills: the **flip-in pill** and the **flip-over pill**. When the common shareholder of the target company has the right to buy its shares at a discount, the pill is known as a flip-in. The pill is triggered when a specific level of ownership is exceeded. Because the acquiring company is generally prohibited from participating in the purchase through the pill, the acquirer is subject to a significant level of dilution. Most plans give the target's board of directors the right to redeem the pill prior to any triggering event. If the takeover becomes friendly, the board generally exercises this waiver.

In the case of a flip-over pill, the target company's common shareholders receive the right to purchase shares of the acquiring company at a significant discount from the market price, which has the effect of causing dilution to all existing acquiring company shareholders. Again, the board of the target generally retains the right to redeem the pill should the transaction become friendly.

Another possible aspect of the poison pill is the **"dead-hand" provision**. This provision allows the board of the target to redeem or cancel the poison pill only by a vote of the continuing directors. Because continuing directors are generally defined as directors who were on the target company's board prior to the takeover attempt, this provision has the effect of making it much more difficult to take over a target without prior board approval.

### 5.1.2 *Poison Puts*

Whereas poison pills grant common shareholders certain rights in a hostile takeover attempt, **poison puts** give rights to the target company's bondholders. In the event of a takeover, poison puts allow bondholders to put the bonds to the company. In other words, if the provision is triggered by a hostile takeover attempt, then bondholders have the right to sell their bonds back to the target at a redemption price that is pre-specified in the bond indenture, typically at or above par value. The effect of a poison put defense is to require that an acquirer be prepared to refinance the target's debt immediately after the takeover. This defense increases the need for cash and raises the cost of the acquisition.

### 5.1.3 *Incorporation in a State with Restrictive Takeover Laws (United States)*

In the United States, many states have adopted laws that specifically address unfriendly takeover attempts. These laws are designed to provide target companies with flexibility in dealing with unwanted suitors. Some states have designed their laws to give the company maximum protection and leeway in defending against an offer. As a result,

companies that anticipate the possibility of a hostile takeover attempt may find it attractive to reincorporate in a jurisdiction that has enacted strict anti-takeover laws. Ohio and Pennsylvania are examples of two US states that have been regarded historically as “target friendly” states; their state laws tend to give target companies the most power in defending against hostile takeover attempts.<sup>7</sup>

#### **5.1.4 Staggered Board of Directors**

Instead of electing the entire board of directors each year at the company’s annual meeting, a company may arrange to stagger the terms for board members so that only a portion of the board seats are due for election each year. For example, if the company has a board consisting of nine directors, members could be elected for three-year terms with only three directors coming up for election each year. The effect of this staggered board is that it would take at least two years to elect enough directors to take control of the board.

#### **5.1.5 Restricted Voting Rights**

Some target companies adopt a mechanism that restricts stockholders who have recently acquired large blocks of stock from voting their shares. Usually, there is a trigger stockholding level, such as 15 or 20 percent. Shareholders who meet or exceed this trigger point are no longer able to exercise their voting rights without the target company’s board releasing the shareholder from the constraint. The possibility of owning a controlling position in the target without being able to vote the shares serves as a deterrent.

#### **5.1.6 Supermajority Voting Provisions**

Many target companies change their charter and bylaws to provide for a higher percentage approval by shareholders for mergers than normally is required. A typical provision might require a vote of 80 percent of the outstanding shares of the target company (as opposed to a simple 51 percent majority). This supermajority requirement is triggered by a hostile takeover attempt and is frequently accompanied by a provision that prevents the hostile acquirer from voting its shares. Thus, even if an acquirer is able to accumulate a substantial portion of the target’s shares, it may have great difficulty accumulating enough votes to approve a merger.

#### **5.1.7 Fair Price Amendments**

Fair price amendments are changes to the corporate charter and bylaws that disallow mergers for which the offer is below some threshold. For example, a fair price amendment might require an acquirer to pay at least as much as the highest stock price at which the target has traded in the public market over a specified period. Fair price amendments protect targets against temporary declines in their share prices by setting a floor value bid. Additionally, fair price amendments protect against two-tiered tender offers where the acquirer offers a higher bid in a first step tender offer with the threat of a lower bid in a second step tender offer for those who do not tender right away.

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<sup>7</sup> Delaware has historically been the most popular state for corporations to domicile their legal entities. To protect this status, the state has found it necessary to toughen its laws regarding takeover attempts. In the past, as some states adopted strict takeover laws, some corporations left Delaware and reincorporated in these “friendly” states. In order to compete, Delaware has changed its own laws to make it more difficult to take over a Delaware corporation on a hostile basis.

### 5.1.8 *Golden Parachutes*

Golden parachutes are compensation agreements between the target company and its senior managers. These employment contracts allow the executives to receive lucrative payouts, usually several years' worth of salary, if they leave the target company following a change in corporate control. In practice, golden parachutes do not offer much deterrent, especially for large deals where the managers' compensation is small relative to the overall takeover price. One reason they persist is that they help alleviate target management's concerns about job loss. Golden parachutes may encourage key executives to stay with the target as the takeover progresses and the target explores all options to generate shareholder value. Without a golden parachute, some contend that target company executives might be quicker to seek employment offers from other companies to secure their financial future. Whether this is actually the case and whether golden parachutes are fair and in the best interest of shareholders is the subject of considerable debate among shareholder rights activists and senior managers.

## 5.2 Post-Offer Takeover Defense Mechanisms

A target also has several defensive mechanisms that can be used once a takeover has already been initiated. Because they may not be as successful when used in isolation and because they have historically been subject to greater scrutiny by the courts, post-offer defenses are typically used in conjunction with pre-offer defenses.

### 5.2.1 *"Just Say No" Defense*

Probably the simplest place for a target company to start when confronted with a hostile takeover bid is to rely on pre-takeover defenses and to decline the offer. If the acquirer attempts a bear hug or tender offer, then target management typically lobbies the board of directors and shareholders to decline and build a case for why the offering price is inadequate or why the offer is otherwise not in the shareholders' best interests. This strategy forces the hopeful acquirer to adjust its bid or further reveal its own strategy in order to advance the takeover attempt.

### 5.2.2 *Litigation*

A popular technique used by many target companies is to file a lawsuit against the acquiring company based on alleged violations of securities or antitrust laws. In the United States, these suits may be filed in either state or federal courts. Unless there is a serious antitrust violation, these suits rarely stop a takeover bid. Instead, lawsuits often serve as a delaying tactic to create additional time for target management to develop other responses to the unwanted offer. Generally, any securities law violations, even if upheld, can be corrected with additional public disclosures. In the United States, most antitrust claims that eventually prevent takeover attempts are initiated by either antitrust or securities regulators rather than by the target company.

### 5.2.3 *Greenmail*

This technique involves an agreement allowing the target to repurchase its own shares back from the acquiring company, usually at a premium to the market price. Greenmail is usually accompanied by an agreement that the acquirer will not pursue another hostile takeover attempt of the target for a set period. In effect, greenmail is the termination of a hostile takeover through a payoff to the acquirer. The shareholders of the target company do not receive any compensation for their shares. Greenmail was popular in the United States during the 1980s, but its use has been extremely restricted since 1986 when the US Internal Revenue Code was amended to add a 50 percent tax on profits realized by acquirers through greenmail.

#### 5.2.4 Share Repurchase

Rather than repurchasing only the shares held by the acquiring company, as in greenmail, a target might use a share repurchase to acquire shares from any shareholder. For example, a target may initiate a cash tender offer for its own outstanding shares. An effective repurchase can increase the potential cost for an acquirer by either increasing the stock's price outright or by causing the acquirer to increase its bid to remain competitive with the target company's tender offer for its own shares. Additionally, a share repurchase often has the effect of increasing the target company's use of leverage because borrowing is typically required to purchase the shares. This additional debt makes the target less attractive as a takeover candidate.

In some cases, a target company buys all of its shares and converts to a privately held company in a transaction called a leveraged buyout. In a **leveraged buyout** (LBO), the management team generally partners with a private equity firm that specializes in buyouts. The new entity borrows a high proportion of the overall purchase price; the financial firm contributes a certain amount of capital; and the management team provides the management expertise to run the business. In exchange for their expertise, management generally receives a payout percentage based on the profitability and success of the company after the LBO is completed. This strategy may allow the target to defend against a hostile bid provided that the LBO provides target shareholders with a level of value that exceeds the would-be acquirer's offer.

#### 5.2.5 Leveraged Recapitalization

A technique somewhat related to the leveraged buyout is the leveraged recapitalization. A **leveraged recapitalization** involves the assumption of a large amount of debt that is then used to finance share repurchases (but in contrast to a leveraged buyout, in a recapitalization, some shares remain in public hands). The effect is to dramatically change the company's capital structure while attempting to deliver a value to target shareholders in excess of the hostile bid.

#### 5.2.6 "Crown Jewel" Defense

After a hostile takeover is announced, a target may decide to sell off a subsidiary or asset to a third party. If the acquisition of this subsidiary or asset was one of the acquirer's major motivations for the proposed merger, then this strategy could cause the acquirer to abandon its takeover effort. When a target initiates such a sale after a hostile takeover bid is announced, there is a good chance that the courts will declare this strategy illegal.

#### 5.2.7 Pac-Man® Defense

The target can defend itself by making a counteroffer to acquire the hostile bidder. This technique is rarely used because, in most cases, it means that a smaller company (the target) is making a bid for a larger entity. Additionally, once a target uses a Pac-Man® defense, it forgoes the ability to use a number of other defensive strategies. For instance, after making a counteroffer, a target cannot very well take the acquirer to court claiming an antitrust violation.

#### 5.2.8 White Knight Defense

Often the best outcome for target shareholders is for the target company's board to seek a third party to purchase the company in lieu of the hostile bidder. This third party is called a **white knight** because it is coming to the aid of the target. A target usually initiates this technique by seeking out another company that has a strategic fit with the target. Based on a good strategic fit, the third party can often justify a higher price for the target than what the hostile bidder is offering.

Once a white knight bid is made public, it may elicit an additional higher bid from the hostile bidder. This can help kick off a competitive bidding situation. In some cases, because of the competitive nature of the bidders, the winner's curse can prevail and the target company shareholders may receive a very good deal. **Winner's curse** is the tendency for the winner in certain competitive bidding situations to overpay, whether because of overestimation of intrinsic value, emotion, or information asymmetries.<sup>8</sup>

#### 5.2.9 White Squire Defense

In the **white squire** defense, the target seeks a friendly party to buy a substantial minority stake in the target—enough to block the hostile takeover without selling the entire company. Although the white squire may pay a significant premium for a substantial number of the target's shares, these shares may be purchased directly from the target company and the target shareholders may not receive any of the proceeds.<sup>9</sup>

The use of the white squire defense may carry a high litigation risk depending on the details of the transaction and local regulations. Additionally, stock exchange listing requirements sometimes require that target shareholders vote to approve these types of transactions, and shareholders may not endorse any transaction that does not provide an adequate premium to them directly.

#### EXAMPLE 6

#### Engelhard Takeover Defenses

On 14 December 2005, BASF, a worldwide producer of chemicals and high-performance products, offered to acquire Engelhard Corporation for \$37 cash per share. Engelhard, a manufacturer and developer of value-added technologies, determined that the \$37 offer was inadequate and decided to defend itself against the unwanted takeover attempt.

Prior to the BASF takeover offer, Engelhard had participating preferred stock purchase rights in place.<sup>10</sup> These rights acted as a poison pill by allowing Engelhard to issue shares at a discount if triggered by a takeover that was unsupported by Engelhard's board of directors. Additionally, in advance of the takeover attempt, Engelhard restated its certificate of incorporation to include a supermajority provision. It stated that business combinations with a holder of more than 5 percent of Engelhard's outstanding shares would require an affirmative vote of both the holders of 80 percent of the outstanding shares and at least 50 percent of the outstanding shares not held by the acquirer unless the board of directors approved the business combination.

After the tender offer was commenced by BASF, Engelhard also pursued a recapitalization plan that involved the repurchase of approximately 20 percent of Engelhard's outstanding shares through a tender offer at \$45 per share, a price superior to BASF's tender offer. Together these pre- and post-offer defenses made it very difficult for BASF to succeed with its \$37 cash tender offer.

Although Engelhard did not complete the tender for its own shares, the recapitalization plan was incentive enough for BASF to increase its offer. Takeover targets frequently use their takeover defenses to negotiate a better deal for their shareholders. After much negotiation, BASF increased its tender offer

<sup>8</sup> The winner's curse is most likely to occur when the target company has roughly the same value to all bidders but the target's true value is hard to ascertain. The average bid in such cases may represent the best estimate of the target's intrinsic value, and the high (winning), an overestimate of its intrinsic value.

<sup>9</sup> For example, the white squire may purchase shares of convertible preferred stock instead of common stock.

<sup>10</sup> Shares of participating preferred stock offer the possibility of a higher dividend when the dividend on common shares reaches a pre-specified threshold.

and Engelhard withdrew all takeover defenses. On 30 May 2006, the companies announced a definitive merger agreement under which BASF would acquire all outstanding shares of Engelhard for \$39 per share in cash.

## REGULATION

# 6

Even when a merger has been accepted by the target company's senior managers, the board of directors, and shareholders, the combination must still be approved by regulatory authorities. Additionally, there are a variety of rules that companies must follow when initiating and completing the merger transaction itself. This section provides an overview of the key rules and issues that arise from M&A activity.

The two major bodies of jurisprudence relating to mergers are antitrust law and securities law. Antitrust laws are intended to ensure that markets remain competitive; the securities laws we will discuss are concerned largely with maintaining both fairness in merger activities and confidence in the financial markets.

### 6.1 Antitrust

Most countries have antitrust laws, which prohibit mergers and acquisitions that impede competition. Antitrust legislation began in the United States with the Sherman Antitrust Act of 1890, which made contracts, combinations, and conspiracies in restraint of trade or attempts to monopolize an industry illegal. The Sherman Antitrust Act was not effective at deterring antitrust activity partly because the US Department of Justice at the time lacked the resources necessary to enforce the law rigorously. Within a few years of its passage, the law was challenged in the courts and rendered unenforceable because of ambiguous aspects of its wording.

To resurrect antitrust law, the US Congress passed the Clayton Antitrust Act in 1914, which clarified and strengthened the Sherman Antitrust Act by detailing the specific business practices that the US Congress wished to outlaw. In order to ensure that the law could be effectively enforced, the legislature also passed the Federal Trade Commission Act of 1914, which established the Federal Trade Commission (FTC) as a regulatory agency to work in tandem with the Department of Justice to enforce antitrust law.

During the ensuing years, additional weaknesses and loopholes in antitrust legislation became apparent. For instance, the Clayton Act regulated only the acquisition of shares of stock, not the acquisition of assets. The Celler–Kefauver Act was passed in 1950 to close this loophole; the law also addressed vertical and conglomerate mergers, whereas previous legislation had focused primarily on horizontal combinations.

The last major piece of US antitrust legislation was the Hart–Scott–Rodino Antitrust Improvements Act of 1976, which required that the FTC and Department of Justice have the opportunity to review and approve mergers in advance. A key benefit of the Hart–Scott–Rodino Act is that it gives regulators an opportunity to halt a merger prior to its completion rather than having to disassemble a company after a merger is later deemed to be anticompetitive.

Just as US transactions are reviewed by the FTC and the Department of Justice, the European Commission (EC) has the authority to review the antitrust implications of transactions among companies that generate significant revenues within the European Union. Although the European Commission's member states have jurisdiction on mergers within their respective national borders, mergers with significant cross-border effects are subject to EC review. Similar to the requirements in the United States, pre-merger notification is required.

In addition to regulatory watchdogs, such as the FTC and the European Commission, approval may be needed from other regulatory agencies. For example, in the United States, a merger involving banks requires approvals from state banking authorities as well as the Federal Reserve Bank and possibly the Federal Deposit Insurance Corporation (FDIC). Insurance mergers require the approval of state insurance commissioners. In some cases where one of the company's businesses is deemed to be of strategic national interest, additional government approvals may be necessary. Each merger must be analyzed by legal experts to determine the specific regulatory approvals required to comply with the relevant rules and laws. This is a very specialized area and can cause significant delays in the closing of some transactions.

The situation can become further complicated when the merging companies have a global presence that falls within multiple jurisdictions of regulatory control. For example, a large trans-Atlantic merger would require approval of both the United States regulatory bodies and the European Commission. Global companies often face dozens of regulatory agencies with different standards and filing requirements. For example, Coca-Cola Company's 1999 acquisition of the Cadbury Schweppes beverage brands involved sales and production in more than 160 countries, requiring antitrust approval in more than 40 jurisdictions around the world.

Prior to 1982, the FTC and Department of Justice used market share as a measure of market power when determining potential antitrust violations among peer competitors in an industry. Using a simple measure of industry concentration and the market shares of the acquirer and the target, companies contemplating a horizontal merger could determine in advance whether the combination would likely be challenged. The transparency and predictability of the measure was advantageous, but the approach proved to be too simplistic and rigid in practice.

In 1982, the agencies shifted toward using a new measure of market power called the **Herfindahl-Hirschman Index (HHI)**. By summing the squares of the market shares for each company in an industry, the HHI does a better job of modeling market concentration while remaining relatively easy to calculate and interpret. To calculate the HHI, the market shares for competing companies are squared and then summed:

$$\text{HHI} = \sum_i^n \left( \frac{\text{Sales or output of firm } i}{\text{Total sales or output of market}} \times 100 \right)^2 \quad (1)$$

Regulators initially calculate the HHI based on *post-merger* market shares. If post-merger market shares result in an HHI of less than 1,000, the market is not considered to be concentrated and a challenge is unlikely unless other anticompetitive issues arise. A moderately concentrated HHI measure of between 1,000 and 1,800, or a highly concentrated measure of more than 1,800, requires a comparison of post-merger and pre-merger HHI. A merger resulting in an increase of 100 points in a moderately concentrated market or 50 points in a highly concentrated market is likely to evoke antitrust concerns; smaller increases are less likely to pose a problem.<sup>11</sup> Exhibit 2 summarizes HHI ranges and the corresponding probability for regulatory action:

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<sup>11</sup> See the US Department of Justice and the Federal Trade Commission's Horizontal Merger Guidelines, issued 2 April 1992 and revised 8 April 1997.

**Exhibit 2 HHI Concentration Level and Possible Government Action**

HHI Concentration Level			
Post-Merger HHI	Concentration	Change in HHI	Government Action
Less than 1,000	Not concentrated	Any amount	No action
Between 1,000 and 1,800	Moderately concentrated	100 or more	Possible challenge
More than 1,800	Highly concentrated	50 or more	Challenge

**EXAMPLE 7****Herfindahl–Hirschman Index**

Given an industry with 10 competitors and the following market shares, calculate the pre-merger HHI. How would the HHI change if Companies 2 and 3 merged? How would it change if Companies 9 and 10 merged instead? Would either set of mergers be likely to evoke an antitrust challenge?

Company	1	2	3	4	5	6	7	8	9	10
Market Share (%)	25	20	10	10	10	5	5	5	5	5

**Solution:**

To calculate the pre-merger HHI, first square the market share for each company. Then add together the squared market shares to obtain an HHI of 1,450, which indicates that this is a moderately concentrated industry. If Companies 2 and 3 were to merge, the HHI would jump 400 points to 1,850. The large change in the HHI combined with the high post-merger HHI value indicates that this merger would likely evoke antitrust objections. If Companies 9 and 10 were to merge instead of Companies 2 and 3, the HHI would climb only 50 points to 1,500. Although the post-merger HHI indicates a moderately concentrated industry, the combination is unlikely to raise antitrust concerns because the post-merger HHI is only 50 points higher than the pre-merger HHI.

Pre-Merger			Post-Merger: Companies 2 and 3			Post-Merger: Companies 9 and 10		
Company	Market Share (%)	Market Share Squared	Company	Market Share (%)	Market Share Squared	Company	Market Share (%)	Market Share Squared
1	25	625	1	25	625	1	25	625
2	20	400	2 + 3	30	900	2	20	400
3	10	100	4	10	100	3	10	100
4	10	100	5	10	100	4	10	100
5	10	100	6	5	25	5	10	100
6	5	25	7	5	25	6	5	25
7	5	25	8	5	25	7	5	25
8	5	25	9	5	25	8	5	25
9	5	25	10	5	25	9 + 10	10	100
10	5	25						

(continued)

Pre-Merger		Post-Merger: Companies 2 and 3				Post-Merger: Companies 9 and 10			
Company	Market Share (%)	Market Share Squared	Company	Market Share (%)	Market Share Squared	Company	Market Share (%)	Market Share Squared	
HHI:	1,450		HHI:	1,850		HHI:	1,500		
			HHI Change:	400		HHI Change:	50		

Although the introduction of the Herfindahl–Hirschman Index was an improvement, regulators still found it to be too mechanical and inflexible. Thus, by 1984, the Department of Justice sought to increase the flexibility of its policies through the inclusion of additional information, such as market power measured by the responsiveness of consumers to price changes, as well as qualitative information, such as the efficiency of companies in the industry, the financial viability of potential merger candidates, and the ability of US companies to compete in foreign markets.<sup>12</sup>

When reviewing quantitative and qualitative data, one should note that merger guidelines are just that—guidelines. It is possible that under unusual circumstances the government may not challenge one merger that does violate the guidelines and may challenge another merger that does not. Each transaction must be analyzed carefully to fully explore all potential antitrust issues.

When conflicts between companies and regulators arise, it is often because of disagreements about how the markets are defined. Regulators must consider the market in terms of both geography and product. When considering the industry's geography, regulators must decide whether the relevant competitors are global, national, regional, or local. When considering product offerings, there may be one or multiple relevant product market overlaps. In some cases the overlap may be clear, and in other transactions it may not be obvious.

Parties to the transaction are usually counseled by attorneys who have relevant experience in the antitrust area. Most companies try to complete their analyses prior to signing a merger agreement in order to avoid entering into a long period of uncertainty while the government decides whether to challenge the transaction. Not only do delays increase costs, but they may also cause the companies to lose other important strategic opportunities.

## 6.2 Securities Laws

As we discussed in the section covering pre-offer takeover defense mechanisms, in the United States individual states regulate M&A activities to varying degrees. But companies must also comply with federal US securities regulations. In the United States, the cornerstone of securities legislation regulating merger and acquisition activities is the Williams Amendment to the Securities Exchange Act of 1934 (also known as the Williams Act), which was passed in 1968 near the end of the third merger wave.

During the 1960s, tender offers became a popular means to execute hostile takeovers. Acquirers often announced tender offers that expired in short time frames or threatened lower bids and less desirable terms for those shareholders who waited to tender. In addition to giving shareholders little time to evaluate the fairness of

<sup>12</sup> Patrick A. Gaughan, *Mergers, Acquisitions, and Corporate Restructurings*, 3rd ed. (New York: John Wiley & Sons, 2002), p. 95.

an offer, it gave target management little time to respond. The Williams Act sought to remedy these problems in two key ways: disclosure requirements and a formal process for tender offers.

Section 13(d) of the Williams Act requires public disclosure whenever a party acquires 5 percent or more of a target's outstanding common stock. As part of this disclosure, the company acquiring the stake must provide a variety of details, including self-identification, the purpose of the transaction, and the source of the funds used to finance the stock purchases. This disclosure requirement calls target managers' and shareholders' attention to large share purchases, which keeps acquirers from gaining too large a toehold before the target is aware of the acquirer's interest.

Section 14 of the Williams Act creates a tender offer process by setting forth various rules and restrictions that companies must observe. For example, as part of initiating a tender offer, an acquirer must file a public statement that contains the details of the offer and information about the acquirer. Target management must then respond through a formal statement containing their opinion and advice to accept or reject the offer; target management can abstain from offering an opinion as long as they provide the reasons for doing so.

Other important provisions of Section 14 are that the tender offer period be at least 20 business days, that the acquirer must accept all shares tendered, that all tendered shares must receive the same price, and that target shareholders can withdraw tendered shares during the offer period. These provisions ensure that target shareholders receive equitable treatment and that they have adequate time to investigate and evaluate a tender offer without the risk of receiving a lower price. Section 14 also gives target management the time and opportunity to adequately respond to a hostile tender offer.

## MERGER ANALYSIS

# 7

In this section, we will examine the analysis of merger activity from two perspectives. First, we will discuss valuation of the target company, something of key importance for analysts on both sides of the deal as well as for shareholders as they all grapple to determine the fairness and adequacy of an offer. Then, we will discuss the analysis of the bid. Analysts can estimate the distribution of benefits in a merger based on expected synergies relative to the premium paid for the target in excess of its intrinsic value.

### 7.1 Target Company Valuation

The three basic valuation techniques that companies and their advisers use to value companies in an M&A context are discounted cash flow analysis, comparable company analysis, and comparable transaction analysis. An analyst is likely to use some combination of these primary techniques, and possibly others, when gauging a company's fair value.

#### 7.1.1 Discounted Cash Flow Analysis

**Discounted cash flow (DCF) analysis**, as it is generally applied in this context, discounts the company's expected future free cash flows to the present in order to derive an estimate for the value of the company. **Free cash flow** (FCF) is the relevant measure in this context because it represents the actual cash that would be available to the company's investors after making all investments necessary to maintain the company

as an ongoing enterprise.<sup>13</sup> Free cash flows are the internally generated funds that can be distributed to the company's investors (e.g., shareholders and bondholders) without impairing the value of the company.

There are several variations to the models an analyst might use to estimate and discount free cash flows. In the following, we will develop an approximation to free cash flow and illustrate its use in valuation using a two-stage model.<sup>14</sup> Estimating a company's free cash flows begins with the creation of pro forma financial statements. The first step is to select an appropriate time horizon for the first stage. The first stage should include only those years over which the analyst feels capable of generating reasonably accurate estimates of the company's free cash flows. These free cash flow estimates are then discounted to their present value.

To incorporate value deriving from years beyond the first stage, the analyst estimates the value of expected second-stage free cash flows as of the end of the first stage. The result is the so-called terminal value (or continuing value) of the company. The analyst then discounts the terminal value back to the present. The sum of the two pieces (the present value of first-stage expected free cash flows plus the present value of the company's terminal value) is the estimated value of the company.

There is no standard approach for creating pro forma financial statements. The art of financial analysis involves an ability to use the appropriate tools and to exercise good judgment in order to produce the best possible estimates for each financial statement item. In the process, analysts make adjustments to their prior projections based on proposed synergies and the announced plans for the merged company. For example, duplicated resources might result in the sale of one of the target's divisions. Or, the operating costs might be adjusted downward in anticipation of economies of scale. These adjustments are easier to estimate in friendly mergers where the analyst has access to detailed financial data about the target than in hostile mergers. But even in a hostile merger scenario, an analyst with experience in the appropriate industry can still make reasonably good estimates.

Once pro forma financial statements have been generated, the analyst can begin the conversion from pro forma net income to pro forma free cash flow for each year of the first stage. To demonstrate this process, we will use the pro forma financial statements and FCF calculations provided in Exhibit 3. The perspective is that of a valuation being done at the beginning of 2007.

### Exhibit 3 Sample Pro Forma Financial Statements and FCF Calculations

	Historical		Pro Forma			
	2006	2007	2008	2009	2010	2011
<b>Income Statement (Thousands of Dollars)</b>						
Revenues	\$14,451	\$15,752	\$17,327	\$19,060	\$20,966	\$23,063
Cost of goods sold	7,948	8,664	9,530	10,483	11,531	12,685
Gross profit	\$6,503	\$7,088	\$7,797	\$8,577	\$9,435	\$10,378
Selling, general, and administrative expenses	2,168	2,363	2,599	2,859	3,145	3,459
Depreciation	506	551	606	667	734	807

<sup>13</sup> Free cash flow as used here is also called **free cash flow to the firm**, particularly when a distinction is being made between free cash flows accruing to all providers of capital and those accruing only to equity-holders (**free cash flow to equity**).

<sup>14</sup> See Stowe, Robinson, Pinto, and McLeavey (2002) for details of estimating free cash flow (free cash flow to the firm) more precisely.

### **Exhibit 3 (Continued)**

	Historical		Pro Forma			
	2006	2007	2008	2009	2010	2011
Earnings before interest and taxes	\$3,829	\$4,174	\$4,592	\$5,051	\$5,556	\$6,112
Net interest expense	674	642	616	583	543	495
Earnings before taxes	\$3,155	\$3,532	\$3,976	\$4,468	\$5,013	\$5,617
Income tax	1,104	1,236	1,392	1,564	1,755	1,966
Net income	<u>\$2,051</u>	<u>\$2,296</u>	<u>\$2,584</u>	<u>\$2,904</u>	<u>\$3,258</u>	<u>\$3,651</u>
<b>Balance Sheet (Thousands of Dollars)</b>						
Current assets	\$8,671	\$9,451	\$10,396	\$11,436	\$12,580	\$13,838
Net property, plant, and equipment	10,116	11,026	12,129	13,342	14,676	16,144
Total assets	<u>\$18,787</u>	<u>\$20,477</u>	<u>\$22,525</u>	<u>\$24,778</u>	<u>\$27,256</u>	<u>\$29,982</u>
Current liabilities	\$3,613	\$3,938	\$4,332	\$4,765	\$5,242	\$5,766
Deferred income taxes	92	111	132	155	181	209
Long-term debt	7,924	7,548	7,243	6,862	6,394	5,830
Total liabilities	<u>\$11,629</u>	<u>\$11,597</u>	<u>\$11,707</u>	<u>\$11,782</u>	<u>\$11,817</u>	<u>\$11,805</u>
Common stock and paid-in capital	1,200	1,200	1,200	1,200	1,200	1,200
Retained earnings	5,958	7,680	9,618	11,796	14,239	16,977
Shareholders' equity	<u>\$7,158</u>	<u>\$8,880</u>	<u>\$10,818</u>	<u>\$12,996</u>	<u>\$15,439</u>	<u>\$18,177</u>
Total liabilities and shareholders' equity	<u>\$18,787</u>	<u>\$20,477</u>	<u>\$22,525</u>	<u>\$24,778</u>	<u>\$27,256</u>	<u>\$29,982</u>
<b>Selected Pro Forma Cash Flow Data (Thousands of Dollars)</b>						
Change in net working capital		\$455	\$551	\$607	\$667	\$734
Capital expenditures		\$1,461	\$1,709	\$1,880	\$2,068	\$2,275
 <b>FCF Calculations</b>						
	Pro Forma					
	2007	2008	2009	2010	2011	
Net income	\$2,296	\$2,584	\$2,904	\$3,258	\$3,651	
Plus: Net interest after tax	417	400	379	353	322	
Unlevered net income	<u>\$2,713</u>	<u>\$2,984</u>	<u>\$3,283</u>	<u>\$3,611</u>	<u>\$3,973</u>	
Plus: Change in deferred taxes	19	21	23	26	28	
Net op. profit less adj. taxes (NOPLAT)	\$2,732	\$3,005	\$3,306	\$3,637	\$4,001	
Plus: Depreciation	551	606	667	734	807	
Less: Change in net working capital	455	551	607	667	734	
Less: Capital expenditures	<u>1,461</u>	<u>1,709</u>	<u>1,880</u>	<u>2,068</u>	<u>2,275</u>	
Free cash flow	<u>\$1,367</u>	<u>\$1,351</u>	<u>\$1,486</u>	<u>\$1,636</u>	<u>\$1,799</u>	
<b>Valuation Calculations</b>						
WACC	9.41%					
PV of FCF			\$5,802			

*(continued)*

**Exhibit 3 (Continued)**

	Pro Forma				
	2007	2008	2009	2010	2011
Terminal growth rate	6.0%				
Terminal value, 2011	\$55,922				
Terminal value, 2006		\$35,670			
Enterprise Value, 2006			\$41,471		

The calculation of FCF involves first making adjustments to net income to convert it to **net operating profit less adjusted taxes (NOPLAT)**. This adjustment is made so that the resulting estimate of FCF represents the after-tax cash flows available to all providers of capital to the company. The first step in this process is to add net interest after tax to net income. This step removes the tax shield from interest payments and puts the cash flows on common footing with other cash flows that are available to all capital providers of the company.<sup>15</sup> This is referred to as unlevered net income.<sup>16</sup> For the year 2007 in Exhibit 3, pro forma net income for the year is \$2,296 million. There is no reported interest income, so net interest expense is simply \$642,000. The company's estimated tax rate is 35 percent, found by dividing the previous year's income tax by the company's earnings before tax.

Step 1:

$$\text{Unlevered net income} = \text{Net income} + \text{Net interest after tax}$$

$$\begin{aligned} \text{Net interest after tax} &= (\text{Interest expense} - \text{Interest income}) \\ &\quad \times (1 - \text{Tax rate}) \end{aligned} \tag{2}$$

For 2007,

$$\begin{aligned} \text{Unlevered net income} &= \$2,296 + 642(1 - 0.35) = \$2,713 \\ &= \$2.713 \text{ million} \end{aligned}$$

To convert unlevered net income to NOPLAT, we must account for differences in depreciation for financial reporting purposes versus depreciation for tax purposes, which has an impact on cash flows. Companies typically report depreciation for property, plant, and equipment at a faster rate for tax purposes (higher depreciation shields more income from taxes) than for financial reporting purposes (lower depreciation results in higher net income). The differences in depreciation result in different taxes. This difference is accounted for as a liability on the balance sheet—deferred income taxes. To account for this impact on cash flow, we add the change in deferred taxes to unlevered net income (an increase in deferred taxes increases cash flow; a decrease in deferred taxes reduces cash flow).<sup>17</sup>

<sup>15</sup> The tax deductibility of interest will be accounted for later in the calculation when we discount free cash flows by the weighted average cost of capital (WACC).

<sup>16</sup> It is also possible to calculate unlevered net income as earnings before interest and taxes (EBIT)  $\times$  (1 – tax rate).

<sup>17</sup> Some analysts also estimate and subtract the value of after-tax nonoperating income to obtain an estimate more closely reflecting operating results only. See Copeland, Koller, Murrin (2000), Chapter 9, for more details on NOPLAT.

Step 2:

$$\text{NOPLAT} = \text{Unlevered net income} + \text{Change in deferred taxes} \quad (3)$$

For 2007,

$$\begin{aligned}\text{NOPLAT} &= \$2,713 + (111 - 92) = \$2,732 \\ &= \$2.732 \text{ million}\end{aligned}$$

At this point, NOPLAT is adjusted to add back net noncash charges (NCC), which prominently include depreciation (of tangible assets) and amortization and impairment (of intangible assets); noncash charges affect net income but do not represent cash expenditures. To estimate free cash flow, we then subtract the value of necessary or otherwise planned investments in working capital and property, plant, and equipment.<sup>18</sup> They are recorded as the change in net working capital and capital expenditures (capex), respectively.

Step 3:

$$\text{FCF} = \text{NOPLAT} + \text{NCC} - \text{Change in net working capital} - \text{Capex} \quad (4)$$

For 2007,

$$\text{FCF} = \$2,732 + 551 - 455 - 1,461 = \$1,367 = \$1.367 \text{ million}$$

(The only NCC in this example is depreciation)

Summarizing, FCF is approximated by:

	Net income
+	Net interest after tax
	_____
	Unlevered net income
+	Change in deferred taxes
	_____
	Net operating profit less adjusted taxes (NOPLAT)
+	Net noncash charges
-	Change in net working capital
-	Capital expenditures (capex)
	_____
	Free cash flow (FCF)

Once free cash flow has been estimated for each year in the first stage (2007–2011 in Exhibit 3), the free cash flows are discounted back to present at the company's weighted average cost of capital (WACC).<sup>19</sup> When evaluating the target from a non-control perspective, we would use the target's WACC, which reflects that company's existing business risk and operating environment. In anticipation of a merger, however, we would adjust that WACC to reflect any anticipated changes in the target's risk from such actions as a redeployment of assets or change in capital structure.

For the company in Exhibit 3, we will assume that the appropriate discount rate is 9.41 percent. Discounting free cash flow for the years 2007 through 2011 at 9.41 percent results in a present value of \$5.802 million. That is the portion of the company's current value that can be attributed to the free cash flows that occur over the first stage. Next, we must determine the portion of the present value attributable to the company's terminal value, which arises from those cash flows occurring from the end of the first stage to **perpetuity**.

<sup>18</sup> Working capital is defined in this use as current assets (excluding cash and equivalents) minus current liabilities (excluding short-term debt).

<sup>19</sup> For details on the estimation of WACC, see the reading on cost of capital.

There are two standard methods for calculating a terminal value. The first method makes use of the constant growth formula. To apply the constant growth formula, an analyst must select a terminal growth rate, which is the long-term equilibrium growth rate that the company can expect to achieve in perpetuity, accounting for both inflation and real growth. The terminal growth rate is often lower than the growth rate applied during the first stage because any advantages from synergies, new opportunities, or cost reductions are transitory as competitors adjust and the industry evolves over time. The constant growth formula can be applied whenever the terminal growth rate is less than the WACC.

$$\text{Terminal value}_T = \frac{\text{FCF}_T(1 + g)}{(\text{WACC} - g)} \quad (5)$$

where

$\text{FCF}_T$  = free cash flow produced during the final year of the first stage

$g$  = terminal growth rate

For the company in Exhibit 3, we will assume a terminal growth rate of 6.0 percent:

$$\text{Terminal value}_{2011} = \frac{\$1,799(1 + 0.06)}{(0.0941 - 0.06)} = \$55,922 = \$55.922 \text{ million}$$

A second method for estimating the terminal value involves applying a multiple at which the analyst expects the average company to sell at the end of the first stage. The analyst might use a free cash flow or other multiple that reflects the expected risk, growth, and economic conditions in the terminal year. Market multiples are rules of thumb applied by analysts, investment bankers, and venture capitalists to produce rough estimates of a company's value. Multiples tend to vary by industry. They can be based on anything applicable to the industry and correlated with market prices. Some service industries tend to be priced as multiples of EBITDA (earnings before interest, taxes, depreciation, and amortization). In contrast, retail stores in some industries might be priced based on multiples applied to floor space. In these cases, the respective multiples can be used directly to produce a terminal value, or they can be incorporated into a pro forma analysis to convert the multiple into a consistent value for free cash flow.

If the company in Exhibit 3 is in an industry where the typical company sells for about 20 times its free cash flow, then the company's terminal value estimate would be:

$$\text{Terminal value}_{2011} = 20 \times \$1,799 = \$35,980 = \$36.0 \text{ million}$$

Having established an estimate for the terminal value, the analyst must discount it back from the end of the estimate horizon to present. The discount rate used is the same WACC estimate that was previously applied to discount the free cash flows. If we decide that the terminal value found using the constant growth method is more accurate than a market multiple, we would discount that value back five years (2011 back to the present):

$$\text{Terminal value}_{2006} = \frac{\$55,922}{(1 + 0.0941)^5} = \$35,670 = \$35.670 \text{ million}$$

Adding the present value of the free cash flows (\$5.802 million) to the present value of the terminal value (\$35.670 million), we can estimate the value of the company to be \$41.471 million.<sup>20</sup> Note that a large proportion of the company's value is attributable to its terminal value (more than 85 percent in our example). The assumed terminal

<sup>20</sup> The estimate differs slightly from the sum due to rounding.

growth rate and WACC estimate can have a dramatic impact on the terminal value calculation: The final estimate of the company's value will only be as accurate as the estimates used in the model.

### **Advantages of Using Discounted Cash Flow Analysis**

- Expected changes in the target company's cash flows (e.g., from operating synergies and cost structure changes) can be readily modeled.
- An estimate of intrinsic value based on forecast fundamentals is provided by the model.
- Changes in assumptions and estimates can be incorporated by customizing and modifying the model.

### **Disadvantages of Using Discounted Cash Flow Analysis**

- It is difficult to apply when free cash flows do not align with profitability within the first stage. For example, a rapidly expanding company may be profitable but have negative free cash flows because of heavy capital expenditures to the horizon that can be forecast with confidence. The free cash flow value of the company will then derive from a later and harder to estimate period when free cash flow turns positive.
- Estimating cash flows and earnings far into the future is not an exact science. There is a great deal of uncertainty in estimates for the following year, and even greater uncertainty in perpetuity.
- Estimates of discount rates can change over time because of capital market developments or changes that specifically affect the companies in question. These changes can also significantly affect acquisition estimates.
- Terminal value estimates often subject the acquisition value calculations to a disproportionate degree of estimate error. The estimate of terminal value can differ depending on the specific technique used. Additionally, the range of estimates can be affected dramatically by small changes in the assumed growth and WACC estimates.

#### **7.1.2 Comparable Company Analysis**

A second approach that investment bankers use to estimate acquisition values is called "comparable company analysis." In this approach, the analyst first defines a set of other companies that are similar to the target company under review. This set may include companies within the target's primary industry as well as companies in similar industries. The sample should be formed to include as many companies as possible that have similar size and capital structure to the target.

Once a set of comparable companies is defined, the next step is to calculate various relative value measures based on the current market prices of the comparable companies in the sample. Such valuation is often based on enterprise multiples. A company's enterprise value is the market value of its debt and equity minus the value of its cash and investments. Examples include enterprise value to free cash flow, enterprise value to EBITDA, enterprise value to EBIT, and enterprise value to sales. Because the denominator in such ratios is pre-interest, they may be preferred when the companies being compared have differences in leverage. The equity can also be valued directly using equity multiples, such as price to cash flow per share (P/CF), price to sales per share (P/S), price to earnings per share (P/E), and price to book value per share (P/BV).

The specific ratios that the analyst selects are determined by the industry under observation. Often, in addition to common market multiples, analysts will include industry-specific multiples. For instance, in the oil and gas industry, in addition to looking at price paid to earnings and cash flow ratios, many analysts evaluate the price paid per barrel of oil or per thousand cubic feet of natural gas reserves.

Analysts typically review the mean, median, and range for whichever metrics are chosen, and then they apply those values to corresponding estimates for the target to develop an estimated company value. This is quite similar to the approach we discussed earlier for using multiples to produce a terminal value estimate. In this case, however, we are calculating various relative value metrics rather than using an industry rule of thumb.

Each metric (P/E, P/CF, etc.) is likely to produce a different estimate for the target's value. Analysts hope that these values converge because that increases confidence in the overall estimate. To the extent that they diverge, analysts must apply judgment and experience to decide which estimates are producing the most accurate market values.

It should be noted that the value determined up to this point in the process yields an estimate of where the target company should trade as a stock in the marketplace relative to the companies in the sample. In order to calculate an acquisition value, the analyst must also estimate a takeover premium. The **takeover premium** is the amount by which the takeover price for each share of stock must exceed the current stock price in order to entice shareholders to relinquish control of the company to an acquirer. This premium is usually expressed as a percentage of the stock price and is calculated as:

$$\text{PRM} = \frac{(\text{DP} - \text{SP})}{\text{SP}} \quad (6)$$

where

PRM = takeover premium (as a percentage of stock price)

DP = deal price per share of the target company

SP = stock price of the target company<sup>21</sup>

To calculate the relevant takeover premium for a transaction, analysts usually compile a list of the takeover premiums paid for companies similar to the target. Preferably, the calculations will be from the recent past because acquisition values and premiums tend to vary over time and economic cycles.

#### EXAMPLE 8

#### Comparable Company Analysis

Sam Jones, an investment banker, has been retained by the Big Box Company to estimate the price that should be paid to acquire New Life Books Inc. Jones decides to use comparable company analysis to find a fair value for New Life, and has gathered the following information about three comparable companies:

Valuation Variables	Company 1	Company 2	Company 3
Current stock price (\$)	20.00	32.00	16.00
Earnings per share (\$)	1.00	1.82	0.93

<sup>21</sup> The analyst must be careful to note any pre-deal jump in the price that may have occurred because of takeover speculation in the market. In these cases, the analyst should apply the takeover premium to a selected representative price from before any speculative influences on the stock price.

Valuation Variables	Company 1	Company 2	Company 3
Cash flow per share (\$)	2.55	3.90	2.25
Book value per share (\$)	6.87	12.80	5.35
Sales per share (\$)	12.62	18.82	7.62

First, Jones calculates valuation metrics using the data he gathered. For each metric, he also calculates the mean.

Relative Valuation		Company 1	Company 2	Company 3	Mean
Ratio		Company 1	Company 2	Company 3	Mean
P/E	20.00	17.58	17.20	18.26	
P/CF	7.84	8.21	7.11	7.72	
P/BV	2.91	2.50	2.99	2.80	
P/S	1.58	1.70	2.10	1.79	

Jones then applies the mean relative valuation ratios to the corresponding data for New Life Books to estimate the comparable stock price. Because the four valuation metrics produce estimates that are all relatively close, he decides he is comfortable using an average of the four estimates to produce the estimated stock value.

Target Company Valuation Variables	Target Company (a)	Comparable Companies' Valuation Variables	Mean Multiples for Comparable Companies (b)	Estimated Stock Value Based on Comparables (a × b)
Earnings per share	1.95	P/E	18.26	\$35.61
Cash flow per share	4.12	P/CF	7.72	\$31.81
Book value per share	12.15	P/BV	2.80	\$34.02
Sales per share	18.11	P/S	1.79	\$32.42
<b>Estimated stock value</b>				Mean: \$33.47

To determine the proper acquisition or takeover value, Jones must now estimate the relevant takeover premium. Using five of the most recent takeovers of companies that are similar to the target, he has compiled the following estimates:

Target Company	Stock Price Prior to Takeover (\$)	Takeover Price (\$)	Takeover Premium (%)
Target 1	23.00	28.50	23.9
Target 2	17.25	22.65	31.3
Target 3	86.75	102.00	17.6
Target 4	45.00	53.75	19.4
Target 5	36.75	45.00	22.4
<b>Mean premium</b>			22.9

After examining the data, Jones decides that the mean estimated premium is reasonable. His next step is to apply the takeover premium to his mean estimate of the stock price for New Life Books:

Target's estimated stock value	\$33.47
Estimated takeover premium	22.9%
Estimated takeover price of target	$(\$33.47)(1.229) = \$41.14$

From all the calculations and estimates above, Jones concludes that a fair takeover price for the Big Box Company to pay for each share of New Life Books would be \$41.14.<sup>22</sup>

### Advantages of Using Comparable Company Analysis

- This method provides a reasonable approximation of a target company's value relative to similar companies in the market. This assumes that "like" assets should be valued on a similar basis in the market.
- With this method, most of the required data are readily available.
- The estimates of value are derived directly from the market. This is unlike the discounted cash flow method where the takeover value is determined based on many assumptions and estimates.

### Disadvantages of Using Comparable Company Analysis

- The method is sensitive to market mispricing. To illustrate the issue, suppose that the comparable companies are overvalued. A valuation relative to those companies may suggest a value that is too high in the sense that values would be revised downward when the market corrects.
- Using this approach yields a market-estimated fair *stock* price for the target company. In order to estimate a fair *takeover* price, analysts must additionally estimate a fair takeover premium and use that information to adjust the estimated stock price.
- The analysis may be inaccurate because it is difficult for the analyst to incorporate any specific plans for the target (e.g., changing capital structure or eliminating duplicate resources) in the analysis.
- The data available for past premiums may not be timely or accurate for the particular target company under consideration.

#### 7.1.3 Comparable Transaction Analysis

A third common approach to value target companies is known as "comparable transaction analysis." This approach is closely related to comparable company analysis except that the analyst uses details from recent takeover transactions for comparable companies to make direct estimates of the target company's takeover value.

The first step in comparable transaction analysis is to collect a relevant sample of recent takeover transactions. The sample should be as broad as possible but limited to companies in the same industry as the target, or at least closely related. Once the transactions are identified, the analyst can look at the same types of relative value multiples that were used in comparable company analysis (P/E, P/CF, other industry-specific multiples, etc.). In this case, however, we are not comparing the target against market multiples. For this approach we compare the multiples actually paid for similar companies in other M&A deals. As before, analysts typically look at **descriptive statistics**, such as the mean, median, and range for the multiples, and apply judgment and experience when applying that information to estimate the target's value.

<sup>22</sup> As we shall discuss in Section 7.2 (covering bid evaluation), the analysis in Example 8 is not quite complete because the acquirer must evaluate the estimated takeover price relative to any expected synergies.

**EXAMPLE 9****Comparable Transaction Analysis**

Joel Hofer, an analyst with an investment banking firm, has been asked to estimate a fair price for the General Health Company's proposed acquisition of Medical Services, Inc. He has already taken the initial step and assembled a sample containing companies involved in acquisitions within the same industry in which Medical Services operates. These companies have all been acquired in the past two years. Details on the acquisition prices and relevant pricing variables are shown below.

<b>Valuation Variables</b>	<b>Acquired Company 1</b>	<b>Acquired Company 2</b>	<b>Acquired Company 3</b>
Acquisition share price (\$)	35.00	16.50	87.00
Earnings per share (\$)	2.12	0.89	4.37
Cash flow per share (\$)	3.06	1.98	7.95
Book value per share (\$)	9.62	4.90	21.62
Sales per share (\$)	15.26	7.61	32.66

The next step in the process is for Hofer to calculate the multiples at which each company was acquired:

<b>Relative Valuation Ratio</b>	<b>Comparable Company 1</b>	<b>Comparable Company 2</b>	<b>Comparable Company 3</b>	<b>Mean</b>
P/E	16.5	18.5	19.9	18.3
P/CF	11.4	8.3	10.9	10.2
P/BV	3.6	3.4	4.0	3.7
P/S	2.3	2.2	2.7	2.4

After reviewing the distribution of the various values around their respective means, Hofer is confident about using the mean value for each ratio because the range in values above and below the mean is reasonably small. Based on his experience with this particular industry, Hofer believes that cash flows are a particularly important predictor of value for these types of companies. Consequently, instead of finding an equally weighted average, Hofer has decided to apply the weights shown below for calculating a weighted average estimated price.

<b>Target Company Valuation Variables</b>	<b>Target Company (a)</b>	<b>Comparable Companies' Valuation Multiples</b>	<b>Comparable Companies (b)</b>	<b>Mean Multiple Paid for Comparable Companies</b>	<b>Estimated Takeover Value Based on Comparables (c = a × b)</b>	<b>Weight (d)</b>	<b>Weighted Estimates (e = c × d)</b>
Earnings per share	\$ 2.62	P/E	18.3	\$47.95	20%	\$ 9.59	
Cash flow per share	\$ 4.33	P/CF	10.2	\$44.17	40%	\$17.67	
Book value per share	\$12.65	P/BV	3.7	\$46.81	20%	\$ 9.36	
Sales per share	\$22.98	P/S	2.4	\$55.15	20%	\$11.03	
<b>Weighted average estimate</b>							<b>\$47.65</b>

In sum, Hofer multiplied each valuation multiple by the corresponding variable for the target company to produce an estimated takeover value based on each comparable. He then decided to overweight cash flow per share and

calculated a weighted average to determine an overall takeover value estimate of \$47.65 per share for Medical Services, Inc. The same procedure could be repeated using the median, high, and low valuations for each of the valuation variables. This would generate a range of takeover values for Medical Services, Inc.

### **Advantages of Comparable Transaction Approach**

- It is not necessary to separately estimate a takeover premium. The takeover premium is derived directly from the comparable transactions.
- The takeover value estimates come directly from values that were recently established in the market. This is unlike the discounted cash flow method where the takeover value is determined based on many assumptions and estimates.
- The use of prices established through other recent transactions reduces litigation risk for both companies' board of directors and managers regarding the merger transaction's pricing.

### **Disadvantages of Comparable Transaction Approach**

- Because the value estimates assume that the M&A market has properly determined the intrinsic value of the target companies, there is a risk that the real takeover values in past transactions were not accurate. If true, these inaccurate takeover values are imputed in the estimates based on them.
- There may not be any, or an adequate number of, comparable transactions to use for calculating the takeover value. In these cases, analysts may try to use data from related industries. These derived values may not be accurate for the specific industry under study.
- The analysis may be inaccurate because it is difficult for the analyst to incorporate any specific plans for the target (e.g., changing capital structure or eliminating duplicate resources) in the analysis.

## **7.2 Bid Evaluation**

Assessing the target's value is important, but it is insufficient for an assessment of the deal. Even if both the acquirer and the target separately agree on the target company's underlying value, the acquirer will obviously want to pay the lowest price possible while the target will negotiate for the highest price possible. Both the price and form of payment in a merger will determine the distribution of risks and benefits between the counterparties to the deal.

Acquirers must typically pay a premium to induce the owners of the target company to relinquish control. In an M&A transaction, the premium is the portion of the compensation received by the target company's shareholders that is in excess of the pre-merger market value of their shares. The target company's managers will attempt to negotiate the highest possible premium relative to the value of the target company.<sup>23</sup>

$$\text{Target shareholders' gain} = \text{Premium} = P_T - V_T$$

(7)

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<sup>23</sup> A burst of speculative stock activity typically accompanies merger negotiations. This activity typically results in a higher share price for the target company in anticipation of a takeover premium. When conducting a bid evaluation, the analyst should use some combination of an assessment of the company's intrinsic value and a representative stock price from before any merger speculation.

where

$P_T$  = price paid for the target company

$V_T$  = pre-merger value of the target company

The acquirer is willing to pay in excess of the target company's value in anticipation of reaping its own gains. The acquirer's gains are derived from the synergies generated by the transaction—usually from some combination of cost reductions and revenue enhancements. All else constant, synergies increase the value of the acquiring company by the value of the synergies minus the premium paid to target shareholders:

$$\text{Acquirer's gain} = \text{Synergies} - \text{Premium} = S - (P_T - V_T) \quad (8)$$

where

$S$  = synergies created by the business combination

The post-merger value of the combined company is a function of the pre-merger values of the two companies, the synergies created by the merger, and any cash paid to the target shareholders as part of the transaction:

$$V_{A^*} = V_A + V_T + S - C \quad (9)$$

where

$V_{A^*}$  = post-merger value of the combined companies

$V_A$  = pre-merger value of the acquirer

$C$  = cash paid to target shareholders

When evaluating a bid, the pre-merger value of the target company is the absolute minimum bid that target shareholders should accept. Individual shareholders could sell their shares in the open market for that much instead of tendering their shares for a lower bid. At the other extreme, unless there are mitigating circumstances or other economic justifications, the acquirer's shareholders would not want to pay more than the pre-merger value of the target company plus the value of any expected synergies. If the acquirer were to pay more than that, then the acquirer's post-merger value would be lower than its pre-merger value—therefore, a reduction in shareholder value.

Bidding should thus generally be confined to a range dictated by the synergies expected from the transaction, with each side of the transaction negotiating to capture as much of the synergies as possible. Consequently, analysis of a merger depends not only on an assessment of the target company's value but also on estimates of the value of any synergies that the merged company is expected to attain.

Confidence in synergy estimates will have implications not only for the bid price but also for the method of payment. The reason for this is that different methods of payment for the merger—cash offer, stock offer, or mixed offer—inherently provide varying degrees of risk shifting with respect to misestimating the value of merger synergies. To see why this is the case, we will first walk through the evaluation of an offer for each method of payment.

#### EXAMPLE 10

##### Adagio Software Offer

Adagio Software, Inc., and Tantalus Software Solutions, Inc., are negotiating a friendly acquisition of Tantalus by Adagio. The management teams at both companies have informally agreed upon a transaction value of about €12.00 per share of Tantalus Software Solutions stock but are presently negotiating

alternative forms of payment. Sunil Agrawal, CFA, works for Tantalus Software Solutions' investment banking team and is evaluating three alternative offers presented by Adagio Software:

- 1 Cash Offer: Adagio will pay €12.00 per share of Tantalus stock.
- 2 Stock Offer: Adagio will give Tantalus shareholders 0.80 shares of Adagio stock per share of Tantalus stock.
- 3 Mixed offer: Adagio will pay €6.00 plus 0.40 shares of Adagio stock per share of Tantalus stock.

Agrawal estimates that the merger of the two companies will result in economies of scale with a net present value of €90 million. To aid in the analysis, Agrawal has also compiled the following data:

	<b>Adagio</b>	<b>Tantalus</b>
Pre-merger stock price	€15.00	€10.00
Number of shares outstanding (millions)	75	30
Pre-merger market value (millions)	€1,125	€300

Based only on the information given, which of the three offers should Agrawal recommend to the Tantalus Software Solutions management team?

### Solution:

#### *Alternative 1:*

*Cash offer of €12.00 per share of Tantalus stock.* A cash offer is the most straightforward and easiest to evaluate. The price paid for the target company,  $P_T$ , is equal to cash price per share times the number of target shares:  $€12.00 \times 30 \text{ million} = €360 \text{ million}$ . Because Tantalus' value,  $V_T$ , is €300 million, the premium is the difference between the two:  $€360 \text{ million} - €300 \text{ million} = €60 \text{ million}$ .

Adagio's gain in this transaction is €30 million, which equals the value of the synergies minus the premium paid to Tantalus shareholders. A longer way to get to the same conclusion is to remember that the value of the post-merger combined company equals the pre-merger values of both companies plus the value of created synergies less the cash paid to target shareholders:  $V_{A^*} = V_A + V_T + S - C = €1,125 + 300 + 90 - 360 = €1,155 \text{ million}$ . Adagio's pre-merger market value was €1,125 million, and Adagio's gain from the transaction is thus  $€1,155 - 1,125 = €30 \text{ million}$ . Agrawal can divide the post-merger market value of €1,155 by the number of shares outstanding to determine Adagio's post-merger stock price. Under a cash offer, Adagio will not issue additional shares of stock, so Agrawal divides €1,155 by 75 million shares to see that, all else constant, Adagio's stock price after the merger should rise to €15.40.

In an all cash offer, Tantalus shareholders receive €60 million—the premium. Adagio's gain from the transaction equals the expected synergies (€90 million) less the premium paid to Tantalus shareholders (€60 million), which equals €30 million.

#### *Alternative 2:*

*Stock offer of 0.80 shares of Adagio stock per share of Tantalus stock.* A stock offer of 0.80 shares might seem at first glance to be equivalent to a cash offer of €12.00 because Adagio's share price is €15.00 ( $0.80 \times €15 = €12$ ). The results are actually slightly different, however, because Agrawal must account for the dilution that occurs when Adagio issues new shares to Tantalus stockholders. Because there are 30 million shares of the target outstanding, Adagio must issue:  $30 \text{ million} \times 0.80 = 24 \text{ million shares}$ .

To calculate the price paid for Tantalus, Agrawal starts by ascertaining the post-merger value of the combined company. Agrawal uses the same formula as before while using a value of zero for  $C$  because this is a stock offer and no cash is changing hands:  $V_{A^*} = V_A + V_T + S - C = €1,125 + 300 + 90 - 0 = €1,515$  million. Next, Agrawal divides Adagio's post-merger value by the post-merger number of shares outstanding. Because Adagio issued 24 million shares to complete the transaction, Agrawal adds 24 million to the original 75 million shares outstanding and arrives at 99 million. Dividing the post-merger market value by the post-merger number of shares outstanding, Agrawal determines that the value of each share given to Tantalus shareholders is actually worth  $€1,515 \text{ million}/99 \text{ million} = €15.30$  and that the total value paid to Tantalus shareholders is  $€15.30 \times 24 \text{ million} = €367$  million.

The premium is thus  $€367 - 300 = €67$  million, which is  $€7$  million higher than it was for the cash offer. Because the target shareholders receive  $€7$  million more than in the cash offer, the acquirer's gain is correspondingly less. Because the synergies are valued at  $€90$  million and the premium is  $€67$  million, the acquirer's gain under a stock transaction with these terms is  $€23$  million.

#### **Alternative 3:**

*Mixed offer of €6.00 plus 0.40 shares of Adagio stock per share of Tantalus stock.* A mixed offer will still result in some dilution, although not as much as a pure stock offer. Agrawal begins by calculating Adagio's post-merger value. Agrawal inserts  $€180$  million for  $C$  because the company is paying  $€6$  per share for 30 million shares:  $V_{A^*} = V_A + V_T + S - C = €1,125 + 300 + 90 - 180 = €1,335$  million.

Next, Agrawal determines that Adagio must issue 12 million shares to complete the transaction:  $0.40 \times 30 \text{ million} = 12 \text{ million}$ . Combined with the original 75 million shares outstanding, Adagio's post-merger number of shares outstanding will be 87 million. Agrawal divides  $€1,335$  million by 87 million and finds that each share given to the Tantalus shareholders is worth  $€15.35$ .

The total value paid to Tantalus shareholders includes a cash component,  $€6.00 \times 30 \text{ million} = €180$  million, and a stock component, 12 million shares issued with a value of  $€15.35$  each equaling  $€184$  million. Added together, the total value is  $€180 + 184 = €364$  million, and the premium is therefore  $€364 \text{ million} - 300 \text{ million} = €64$  million. The acquirer's gain is \$26 million.

#### **Conclusion:**

Agrawal should recommend that the Tantalus Software Solutions management team opt for the all stock offer because that alternative provides Tantalus shareholders the most value (the highest premium).

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In Example 10, Adagio's gain ranged from  $€30$  million in the pure cash offer to  $€26$  million in the mixed offer and  $€23$  million in the pure stock offer. If the dilution of a stock offer reduces the acquirer's gains from the transaction, why would an acquirer ever pay stock in a merger? The answer brings us back to the beginning of the section where we pointed out that the price and form of payment in a merger determine the distribution of risks and benefits. The choice of payment method is influenced by both parties' confidence in the estimated synergies and the relative value of the acquirer's shares.

The more confident the managers are that the estimated synergies will be realized, the more the acquiring managers will prefer to pay with cash and the more the target managers will prefer to receive stock. And the more the merger is paid for with the acquirer's stock, the more that the risks and benefits of realizing synergies will be passed on to the target shareholders. For example, in the cash offer we analyzed in Example 10, if the synergies later turned out to be worth  $€60$  million rather than the

originally estimated €90 million, then the Tantalus shareholders' premium would be unaffected but Adagio's gain would completely evaporate. In contrast, if the synergies were greater than estimated, then Tantalus shareholders' premium would still be unchanged but Adagio's gain would increase.

When stock is used as payment, the target shareholders become part owners of the acquiring company. In the Adagio stock offer, Tantalus shareholders would receive 24 million shares and thus own 24/99 (24.2 percent) of the post-merger acquirer. Thus, Tantalus shareholders would participate by that proportion in any deviation of synergies from pre-merger estimates. If synergies were worth only €60 million, Adagio would lose its €23 million gain and Tantalus shareholders' gain from the transaction would fall by €7 million.

The other factor affecting the method of payment decision relates to the counterparties' confidence in the companies' relative values. The more confident managers are in estimates of the target company's value, the more the acquirer would prefer cash and the more the target would prefer stock. For example, what if Adagio estimates that Tantalus is worth more than €10 per share and consequently offers €12.50 per share in cash instead of €12.00? In that case, Tantalus shareholders would receive a premium that is €15 million higher and Adagio's gain from the transaction would be reduced by €15 million to €15 million.

## 8

## WHO BENEFITS FROM MERGERS?

What does the empirical evidence say about who actually gains in business combinations? Studies on the performance of mergers fall into two categories: short-term performance studies, which examine stock returns surrounding merger announcement dates, and long-term performance studies of post-merger companies. The empirical evidence suggests that merger transactions create value for target company shareholders in the short run. On average, target shareholders reap 30 percent premiums over the stock's pre-announcement market price, and the acquirer's stock price falls, on average, between 1 and 3 percent.<sup>24</sup> Moreover, on average, both the acquirer and target tend to see higher stock returns surrounding cash acquisition offers than around share offers.<sup>25</sup>

The high average premiums paid to target shareholders may be attributed, at least partly, to the winner's curse—the tendency for competitive bidding to result in overpayment. Even if the average bidding company accurately estimates the target company's value, some bidders will overestimate the target's value and other potential buyers will underestimate its value. Unless the winner can exploit some strong synergies that are not available to other bidders, the winning bidder is likely to be the one who most overestimates the value.

Roll argues that high takeover bids may stem from hubris, from "the over-bearing presumption of bidders that their valuations are correct."<sup>26</sup> Implied in this behavior is that these executives are somehow smarter than everyone else and can see value where others cannot. Even if there were no synergies from a merger, managerial

<sup>24</sup> J. Fred Weston and Samuel C. Weaver, *Mergers & Acquisitions* (New York: McGraw-Hill, 2001), pp. 93 – 116.

<sup>25</sup> Robert F. Bruner, *Deals from Hell: M&A Lessons That Rise above the Ashes* (New York: John Wiley & Sons, 2005), p. 33.

<sup>26</sup> Richard Roll, "The Hubris Hypothesis on Corporate Takeovers," *Journal of Business*, vol. 59 (April 1986), pp. 176 – 216.

hubris would still lead to higher-than-market bids and a transfer of wealth from the acquiring company's shareholders to the target's shareholders. The empirical evidence is consistent with Roll's hubris hypothesis.

When examining a longer period, empirical evidence shows that acquirers tend to underperform comparable companies during the three years following an acquisition. This implies a general post-merger operational failure to capture synergies. Average returns to acquiring companies subsequent to merger transactions are negative 4.3 percent with about 61 percent of acquirers lagging their industry peers.<sup>27</sup> This finding suggests that financial analysts would be well served to thoroughly scrutinize estimates of synergy and post-merger value creation.

Analysts must attempt to distinguish those deals that create value and those that do not. Too often, companies with surplus cash but few new investment opportunities are prone to make acquisitions rather than distribute excess cash to shareholders. When distinguishing value-creating deals, analysts must examine the operational strengths possessed by the acquirer and the target to discern the likelihood that post-merger synergies will be achieved.

Based on past empirical results, the following are characteristics of M&A deals that create value:<sup>28</sup>

- **The buyer is strong.** Acquirers whose earnings and share prices grow at a rate above the industry average for three years before the acquisition earn statistically significant positive returns on announcement.
- **The transaction premiums are relatively low.** Acquirers earn negative returns on announcement when paying a high premium.
- **The number of bidders is low.** Acquirer stock returns are negatively related to the number of bidders.
- **The initial market reaction is favorable.** Initial market reaction is an important barometer for the value investors place on the gains from merging as well as an indication of future returns. If the acquiring company's stock price falls when the deal is announced, investors are sending a message that the merger benefits are doubtful or that the acquirer is paying too much.

## CORPORATE RESTRUCTURING

9

Just as mergers and acquisitions are a means by which companies get bigger, a corporate restructuring is usually used in reference to ways that companies get smaller—by selling, splitting off, or otherwise shedding operating assets. When a company decides to sell, liquidate, or spin off a division or a subsidiary, it is referred to as a **divestiture**.

Given, as we have discussed, that many companies have great difficulty actually achieving the planned synergies of a business combination, it is not surprising that many companies seek to undo previous mergers. Indeed, periods of intense merger

<sup>27</sup> T. Koller, M. Goedhart, and D. Wessels, *Valuation: Measuring and Managing the Value of Companies*, 4th ed. (Hoboken, NJ: John Wiley & Sons, 2005), p. 439, footnotes 3 and 4.

<sup>28</sup> J. Fred Weston and Samuel C. Weaver, *Mergers & Acquisitions* (New York: McGraw-Hill, 2001), Chapter 5.

activity are often followed by periods of heightened restructuring activity. Of course, previous mergers that did not work out as planned are not the only reason companies may choose to divest assets. Some of the common reasons for restructuring follow:

- **Change in strategic focus.** Either through acquisitions or other investments over time, companies often become engaged in multiple markets. Management may hope to improve performance by eliminating divisions or subsidiaries that are outside the company's core strategic focus.
- **Poor fit.** Sometimes a company will decide that a particular division is a poor fit within the overall company. For example, the company may not have the expertise or resources to fully exploit opportunities pursued by the division and may decide to sell the segment to another company that does have the necessary resources. Or, the division might simply not be profitable enough to justify continued investment based on the company's cost of capital.
- **Reverse synergy.** Managers may feel that a segment of the company is undervalued by the market, sometimes because of poor performance of the overall company or because the division is not a good strategic fit. In these cases, it is possible that the division and the company will be worth more separately than combined.
- **Financial or cash flow needs.** If times are tough, managers may decide to sell off portions of the company as a means by which to raise cash or cut expenses.

Restructuring can take many forms, but the three basic ways that a company divests assets are a sale to another company, a spin-off to shareholders, or liquidation. As part of a sale to another company, a company might offer to sell the assets of a division or may offer an equity carve-out. An **equity carve-out** involves the creation of a new legal entity and sales of equity in it to outsiders.

In a **spin-off**, shareholders of the parent company receive a proportional number of shares in a new, separate entity. Whereas the sale of a division results in an inflow of cash to the parent company, a spin-off does not. A spin-off simply results in shareholders owning stock in two different companies where there used to be one. A similar type of transaction is called a **split-off**, where some of the parent company's shareholders are given shares in a newly created entity in exchange for their shares of the parent company. **Liquidation** involves breaking up a company, division, or subsidiary and selling off its assets piecemeal. For a company, liquidation is typically associated with bankruptcy.

## SUMMARY

Mergers and acquisitions are complex transactions. The process often involves not only the acquiring and target companies but also a variety of other stakeholders, including securities antitrust regulatory agencies. To fully evaluate a merger, analysts must ask two fundamental questions: First, will the transaction create value; and second, does the acquisition price outweigh the potential benefit? This reading has made the following important points.

- An acquisition is the purchase of some portion of one company by another. A merger represents the absorption of one company by another such that only one entity survives following the transaction.

- Mergers can be categorized by the form of integration. In a statutory merger, one company is merged into another; in a subsidiary merger, the target becomes a subsidiary of the acquirer; and in a consolidation, both the acquirer and target become part of a newly formed company.
- Horizontal mergers occur among peer companies engaged in the same kind of business. Vertical mergers occur among companies along a given value chain. Conglomerates are formed by companies in unrelated businesses.
- Merger activity has historically occurred in waves. These waves have typically coincided with a strong economy and buoyant stock market activity. Merger activity tends to be concentrated in a few industries, usually those undergoing changes, such as deregulation or technological advancement.
- The motives for M&A activity include synergy, growth, market power, the acquisition of unique capabilities and resources, diversification, increased earnings, management's personal incentives, tax considerations, and the possibilities of uncovering hidden value. Cross-border motivations may involve technology transfer, product differentiation, government policy, and the opportunities to serve existing clients abroad.
- A merger transaction may take the form of a stock purchase (when the acquirer gives the target company's shareholders some combination of cash or securities in exchange for shares of the target company's stock) or an asset purchase (when the acquirer purchases the target company's assets and payment is made directly to the target company). The decision of which approach to take will affect other aspects of the transaction, such as how approval is obtained, which laws apply, how the liabilities are treated, and how the shareholders and the company are taxed.
- The method of payment for a merger can be cash, securities, or a mixed offering with some of both. The exchange ratio in a stock or mixed offering determines the number of shares that stockholders in the target company will receive in exchange for each of their shares in the target company.
- Hostile transactions are those opposed by target managers, whereas friendly transactions are endorsed by the target company's managers. There are a variety of both pre- and post-offer defenses a target can use to ward off an unwanted takeover bid.
- Examples of pre-offer defense mechanisms include poison pills and puts, incorporation in a jurisdiction with restrictive takeover laws, staggered boards of directors, restricted voting rights, supermajority voting provisions, fair price amendments, and golden parachutes.
- Examples of post-offer defenses include “just say no” defense, litigation, green-mail, share repurchases, leveraged recapitalization, “crown jewel” defense, Pac-Man® defense, or finding a white knight or a white squire.
- Antitrust legislation prohibits mergers and acquisitions that impede competition. Major US antitrust legislation includes the Sherman Antitrust Act, the Clayton Act, the Celler–Kefauver Act, and the Hart–Scott–Rodino Act.
- The Federal Trade Commission and Department of Justice review mergers for antitrust concerns in the United States. The European Commission reviews transactions in the European Union.
- The Herfindahl–Hirschman Index (HHI) is a measure of market power based on the sum of the squared market shares for each company in an industry. Higher index values or combinations that result in a large jump in the index are more likely to meet regulatory challenges.

- The Williams Act is the cornerstone of securities legislation for M&A activities in the United States. The Williams Act ensures a fair tender offer process through the establishment of disclosure requirements and formal tender offer procedures.
- Three major tools for valuing a target company are discounted cash flow analysis (which involves discounting free cash flows estimated with pro forma financial statements), comparable company analysis (which estimates a company's intrinsic value based on relative valuation metrics for similar companies), and comparable transaction analysis (which derives valuation from details of recent takeover transactions for comparable companies).
- In a merger bid, the gain to target shareholders is measured as the control premium, which equals the price paid for the target company in excess of its value. The acquirer gains equal the value of any synergies created by the merger minus the premium paid to target shareholders. Together, the bid and the method of payment determine the distribution of risks and returns among acquirer and target shareholders with regard to realization of synergies as well as correct estimation of the target company's value.
- The empirical evidence suggests that merger transactions create value for target company shareholders. Acquirers, in contrast, tend to accrue value in the years following a merger. This finding suggests that synergies are often overestimated or difficult to achieve.
- When a company decides to sell, liquidate, or spin off a division or a subsidiary, it is referred to as a divestiture. Companies may divest assets for a variety of reasons, including a change in strategic focus, poor fit of the asset within the corporation, reverse synergy, or cash flow needs.
- The three basic ways that a company divests assets are a sale to another company, a spin-off to shareholders, and liquidation.

## PRACTICE PROBLEMS

### The following information relates to Questions 1–6

Modern Auto, an automobile parts supplier, has made an offer to acquire Sky Systems, creator of software for the airline industry. The offer is to pay Sky Systems' shareholders the current market value of their stock in Modern Auto's stock. The relevant information it used in those calculations is given below:

	<b>Modern Auto</b>	<b>Sky Systems</b>
Share price	\$40	\$25
Number of outstanding shares (millions)	40	15
Earnings (millions)	\$100	\$30

Although the total earnings of the combined company will not increase and are estimated to be \$130 million, Charles Wilhelm (treasurer of Modern Auto) argues that there are two attractive reasons to merge. First, Wilhelm says, "The merger of Modern Auto and Sky Systems will result in lower risk for our shareholders because of the diversification effect." Second, Wilhelm also says, "If our EPS increases, our stock price will increase in line with the EPS increase because our P/E will stay the same."

Sky Systems managers are not interested in the offer by Modern Auto. The managers, instead, approach HiFly, Inc., which is in the same industry as Sky Systems, to see if it would be interested in acquiring Sky Systems. HiFly is interested, and both companies believe there will be synergies from this acquisition. If HiFly were to acquire Sky Systems, it would do so by paying \$400 million in cash.

HiFly is somewhat concerned whether antitrust regulators would consider the acquisition of Sky Systems an antitrust violation. The market in which the two companies operate consists of eight competitors. The largest company has a 25 percent market share. HiFly has the second largest market share of 20 percent. Five companies, including Sky Systems, each have a market share of 10 percent. The smallest company has a 5 percent market share.

- 1 The acquisition of Sky Systems by Modern Auto and the acquisition of Sky Systems by HiFly, respectively, would be examples of a:
  - A vertical merger and a horizontal merger.
  - B conglomerate merger and a vertical merger.
  - C conglomerate merger and a horizontal merger.
- 2 If Sky Systems were to be acquired by Modern Auto under the terms of the original offer, the post-merger EPS of the new company would be *closest* to:
  - A \$2.00.
  - B \$2.32.
  - C \$2.63.
- 3 Are Wilhelm's two statements about his shareholders benefiting from the diversification effect of the merger and about the increase in the stock price, respectively, correct?

	The Merger Will Result in Lower Risk for Shareholders	Stock Price Will Increase in Line with the EPS Increase
A	No	No
B	No	Yes
C	Yes	No

- 4 Which of the following defenses *best* describes the role of HiFly in the acquisition scenario?
- A Crown jewel.  
 B Pac-Man®.  
 C White knight.
- 5 Suppose HiFly acquires Sky Systems for the stated terms. The gain to Sky Systems shareholders resulting from the merger transaction would be *closest* to:
- A \$25 million.  
 B \$160 million.  
 C \$375 million.
- 6 If HiFly and Sky Systems attempt to merge, the increase in the Herfindahl-Hirschman Index (HHI) and the probable action by the Department of Justice and the FTC, respectively, in response to the merger announcement are:

	Increase in the HHI	Probable Response of Department of Justice and FTC
A	290	To challenge the merger
B	290	To investigate the merger
C	400	To challenge the merger

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## The following information relates to Questions 7–12

Kinetic Corporation is considering acquiring High Tech Systems. Jim Smith, the vice president of finance at Kinetic, has been assigned the task of estimating a fair acquisition price for High Tech. Smith is aware of several approaches that could be used for this purpose. He plans to estimate the acquisition price based on each of these approaches, and has collected or estimated the necessary financial data.

High Tech has 10 million shares of common stock outstanding and no debt. Smith has estimated that the post-merger free cash flows from High Tech, in millions of dollars, would be 15, 17, 20, and 23 at the end of the following four years. After Year 4, he projects the free cash flow to grow at a constant rate of 6.5 percent a year. He determines that the appropriate rate for discounting these estimated cash flows is 11 percent. He also estimates that after four years High Tech would be worth 23 times its free cash flow at the end of the fourth year.

Smith has determined that three companies—Alpha, Neutron, and Techno—are comparable to High Tech. He has also identified three recent takeover transactions—Quadrant, ProTech, and Automator—that are similar to the takeover of High Tech

under consideration. He believes that price-to-earnings, price-to-sales, and price-to-book value per share of these companies could be used to estimate the value of High Tech. The relevant data for the three comparable companies and for High Tech are as follows:

Valuation Variables	Alpha	Neutron	Techno	High Tech
Current stock price (\$)	44.00	23.00	51.00	31.00
Earnings/share (\$)	3.01	1.68	2.52	1.98
Sales/share (\$)	20.16	14.22	18.15	17.23
Book value/share (\$)	15.16	7.18	11.15	10.02

The relevant data for the three recently acquired companies are given below:

Valuation Variables	Quadrant	ProTech	Automator
Stock price pre-takeover (\$)	24.90	43.20	29.00
Acquisition stock price (\$)	28.00	52.00	34.50
Earnings/share (\$)	1.40	2.10	2.35
Sales/share (\$)	10.58	20.41	15.93
Book value/share (\$)	8.29	10.14	9.17

While discussing his analysis with a colleague, Smith makes two comments. Smith's first comment is: "If there were a pre-announcement run-up in Quadrant's price because of speculation, the takeover premium should be computed based on the price prior to the run-up." His second comment is: "Because the comparable transaction approach is based on the acquisition price, the takeover premium is implicitly recognized in this approach."

- 7 What is the present value per share of High Tech stock using the discounted cash flow approach if the terminal value of High Tech is based on using the constant growth model to determine terminal value?
  - A \$39.38.
  - B \$40.56.
  - C \$41.57.
- 8 What is the value per share of High Tech stock using the discounted cash flow approach if the terminal value of High Tech is based on using the cash flow multiple method to determine terminal value?
  - A \$35.22.
  - B \$40.56.
  - C \$41.57.
- 9 The average stock price of High Tech for the three relative valuation ratios (if it is traded at the mean of the three valuations) is *closest* to:
  - A \$35.21.
  - B \$39.38.
  - C \$40.56.
- 10 Taking into account the mean takeover premium on recent comparable takeovers, what would be the estimate of the fair acquisition price of High Tech based on the comparable company approach?
  - A \$35.22.
  - B \$40.83.
  - C \$41.29.

- 11** The fair acquisition price of High Tech using the comparable transaction approach is *closest* to:
- \$35.22.
  - \$40.86.
  - \$41.31.
- 12** Are Smith's two comments about his analysis correct?
- Both of his comments are correct.
  - Both of his comments are incorrect.
  - His first comment is correct, and his second comment is incorrect.
- 

**The following information relates to Questions 13–18 and is based on “Corporate Governance” and this reading**

Mark Zin and Stella Lee are CEO and CFO, respectively, of Moonbase Corporation. They are concerned that Moonbase is undervalued and subject to a hostile takeover bid. To assess the value of their own firm, they are reviewing current financial data for Jupiter PLC, Saturn Corporation, and Voyager Corporation, three firms they believe are comparable to Moonbase.

Relative Valuation Ratio	Jupiter	Saturn	Voyager
P/E	23.00	19.50	21.50
P/B	4.24	5.25	4.91
P/CF	12.60	11.40	13.30

Zin believes Moonbase should trade at similar multiples to these firms and that each valuation ratio measure is equally valid. Moonbase has a current stock price of \$34.00 per share, earnings of \$1.75 per share, book value of \$8.50 per share, and cash flow of \$3.20 per share. Using the average of each of the three multiples for the three comparable firms, Zin finds that Moonbase is undervalued.

Lee states that the low valuation reflects current poor performance of a subsidiary of Moonbase. She recommends that the board of directors consider divesting the subsidiary in a manner that would provide cash inflow to Moonbase.

Zin proposes that some action should be taken before a hostile takeover bid is made. He asks Lee if changes can be made to the corporate governance structure in order to make it more difficult for an unwanted suitor to succeed.

In response, Lee makes two comments of actions that would make a hostile takeover more difficult. Lee's first comment is "Moonbase can institute a poison pill that allows our shareholders, other than the hostile bidder, to purchase shares at a substantial discount to current market value." Lee's second comment is: "Moonbase can instead institute a poison put. The put allows shareholders the opportunity to redeem their shares at a substantial premium to current market value."

Zin is also concerned about the general attitude of outside investors with the governance of Moonbase. He has read brokerage reports indicating that the Moonbase governance ratings are generally low. Zin believes the following statements describe characteristics that should provide Moonbase with a strong governance rating.

- Statement 1 Moonbase's directors obtain advice from the corporate counsel to aid them in assessing the firm's compliance with regulatory requirements.
- Statement 2 Five of the ten members of the board of directors are not employed by Moonbase and are considered independent. Though not employed by the company, two of the independent directors are former executives of the company and thus can contribute useful expertise relevant for the business.
- Statement 3 The audit committee of the board is organized so as to have sufficient resources to carry out its task, with an internal staff that reports routinely and directly to the audit committee.

Zin is particularly proud of the fact that Moonbase has begun drafting a "Statement of Corporate Governance" (SCG) that would be available on the company website for viewing by shareholders, investment analysts, and any interested stakeholders. In particular, the SCG pays special attention to policies that ensure effective contributions from the board of directors. These policies include:

- Policy 1 Training is provided to directors prior to joining the board and periodically thereafter.
- Policy 2 Statements are provided of management's assessment of the board's performance of its fiduciary responsibilities.
- Policy 3 Statements are provided of directors' responsibilities regarding oversight and monitoring of the firm's risk management and compliance functions.

Zin concludes the discussion by announcing that Johann Steris, a highly regarded ex-CFO of a major corporation, is under consideration as a member of an expanded board of directors. Zin states that Steris meets all the requirements as an independent director including the fact that he will not violate the interlocking directorship requirement. Steris also will bring experience as a member of the compensation committee of the board of another firm. He also comments that Steris desires to serve on either the audit or compensation committee of the Moonbase board and that good governance practice suggests that Steris would not be prohibited from serving on either committee.

**13** The value the CEO estimated based on comparable company analysis is *closest* to:

- A \$37.33.  
 B \$39.30.  
 C \$40.80.

**14** The divestiture technique that Lee is recommending is *most likely*:

- A a spin-off.  
 B a split-off.  
 C an equity carve-out.

**15** With regard to poison pills and puts, Lee's comments are:

- A correct.  
 B incorrect with regard to the poison put.  
 C incorrect with regard to the poison pill.

**16** Which statement by Zin provides the *most* support for a strong governance rating?

- A Statement 1.  
 B Statement 2.

- C Statement 3.
- 17 Which policy of the Statement of Corporate Governance is *least likely* to ensure effective contributions from the board of directors?
- A Policy 1.  
 B Policy 2.  
 C Policy 3.
- 18 Is Zin's comment that good governance practice does not preclude Steris from serving on either of the two committees of the Moonbase board correct?
- A Yes.  
 B No, good governance practice precludes Steris from serving on the audit committee.  
 C No, good governance practice precludes Steris from serving on the compensation committee.
- 

## The following information relates to Questions 19–24

Josh Logan is a buy-side equity analyst who follows Durtech. Logan's supervisor believes that Durtech is a likely takeover candidate and has asked Logan to estimate the company's value per share in the event of an "all stock" takeover bid. Logan plans to estimate Durtech's value per share using three approaches: discounted cash flow, comparable company analysis, and comparable transaction analysis.

Durtech has 1.2 million common shares outstanding and no outstanding long-term debt or preferred stock. Logan estimates that Durtech's free cash flows at the end of the next three years will be \$5.0 million, \$6.0 million, and \$7.0 million, respectively. After Year 3, he projects that free cash flow will grow at 5 percent per year. He determines the appropriate discount rate for this free cash flow stream is 15 percent per year.

Applying discounted cash flow analysis to the information above, Logan determines that Durtech's fair enterprise value is \$61.8 million. In a separate analysis based on ratios, Logan estimates that at the end of the third year, Durtech will be worth ten times its Year 3 free cash flow.

Logan's supervisor is troubled by the sensitivity of his enterprise value calculation to the terminal growth rate assumption. She asks Logan:

"What is the percentage change in your fair enterprise value of \$61.8 million if you use a terminal growth rate of zero percent rather than 5 percent?"

Logan gathers data on two companies comparable to Durtech: Alphatech and Betatech. He believes that price-to-earnings, price-to-sales, and price-to-book-value per share of these companies should be used to value Durtech. The relevant data for the three companies are given in Exhibit 1.

### Exhibit 1 Valuation Variables for Durtech and Comparable Companies

Valuation Variables	Alphatech	Betatech	Durtech
Current stock price (\$)	72.00	45.00	24.00
Earnings per share (\$)	2.00	1.50	1.00

**Exhibit 1 (Continued)**

<b>Valuation Variables</b>	<b>Alphatech</b>	<b>Betatech</b>	<b>Durtech</b>
Sales per share (\$)	32.00	22.50	16.00
Book value per share (\$)	18.00	10.00	8.00

Logan also identifies one recent takeover transaction and analyzes its takeover premium (the amount by which its takeover price per share exceeds its current stock price). Omegatech is comparable to the possible transaction on Durtech. Omegatech had a stock price of \$44.40 per share prior to a newspaper report of a takeover rumor. After the takeover rumor was reported, the price rose immediately to \$60.30 per share. Eventually, the takeover offer was accepted by Omegatech's shareholders for \$55.00 per share. One-year trailing earnings per share for Omegatech immediately prior to the takeover were \$1.25 per share.

In order to evaluate the risk of government antitrust action, Logan computes the Herfindahl–Hirschman Index (HHI) for the industry group that includes Durtech. He computes the pre-merger value of the HHI to be 1400. As shown in Exhibit 2, Logan also computes the post-merger industry HHI assuming three possible merger scenarios with Durtech.

**Exhibit 2 Post-Merger Industry HHI (Assuming Merger with Durtech)**

<b>Durtech Merger Partner</b>	<b>Post-Merger Industry HHI</b>
Alphatech	1500
Betatech	1510
Gammatech	1520

Based upon this analysis, Logan concludes that the industry is moderately concentrated and that a merger of Durtech (with any of the companies listed in Exhibit 2) will face a possible government challenge.

- 19 Using the discounted cash flow approach and assuming that Durtech's terminal value is based upon the cash flow multiple method, Logan's best estimate of Durtech's current value per share is *closest* to:
  - A \$49.60.
  - B \$51.50.
  - C \$53.51.
- 20 Logan's best response to the supervisor's question concerning the sensitivity of the enterprise value to the terminal growth rate assumption, is *closest* to:
  - A -36.5%.
  - B -28.5%.
  - C -24.8%.
- 21 Based on Exhibit 1 and the mean of each of the valuation ratios, Logan's estimate of Durtech's value per share should be *closest* to:
  - A \$30.44.
  - B \$33.67.

- C \$34.67.
- 22 Based upon the premium on a recent comparable transaction, Logan's best estimate of the takeover premium for Durtech is *closest* to:
- A 19.9%.
- B 23.9%.
- C 35.8%.
- 23 Using comparable transaction analysis, Logan's estimate of the fair acquisition value per share for Durtech is *closest* to:
- A \$35.52.
- B \$42.59.
- C \$44.00.
- 24 The best justification for Logan's conclusion concerning possible government antitrust action is that:
- A the post- and pre-merger HHI are both between 1000 and 1800.
- B the change in the HHI is 100 or more and the post-merger HHI is between 1000 and 1800.
- C the change in the HHI is 100 or more and the pre-merger HHI is between 1000 and 1800.
-

## SOLUTIONS

- 1 C is correct. These are conglomerate and horizontal mergers, respectively.  
 2 C is correct. EPS is \$2.63.

Because Modern Auto's stock price is \$40 and Sky Systems' stock price is \$25, Modern Auto will acquire Sky Systems by exchanging 1 of its shares for  $40/25 = 1.60$  shares of Sky Systems. There are 15 million shares of Sky Systems. Their acquisition will take  $15/1.60 = 9.375$  million shares of Modern Auto. The total number of shares after the merger = 49.375 million. The EPS after the merger =  $130/49.375 = \$2.63$ .

- 3 A is correct. Both of the statements by Wilhelm are wrong.

The first statement is wrong because diversification by itself does not lower risk for shareholders. Investors can diversify very cheaply on their own by purchasing stocks of different companies (for example, a Modern Auto shareholder could purchase stocks of Sky Systems).

The second statement is also wrong. The P/E ratio will not necessarily remain the same following the merger and is more likely to decline. The pre-merger P/E for Modern Auto is  $40/2.50 = 16$ . After the merger, the EPS would be  $\$130$  million/49.375 million shares, or 2.6329. The post-merger P/E will probably fall to  $40/2.6329 = 15.19$ .

- 4 C is correct. HiFly is a white knight.  
 5 A is correct.

$$\text{Target shareholders' gain} = \text{Premium} = P_T - V_T$$

$P_T$  = Price paid for the target company = \$400 million as provided in the vignette

$V_T$  = Pre-merger value of the target = \$25 share price  $\times$  15 million shares = \$375 million

$$\$400 \text{ million} - \$375 \text{ million} = \$25 \text{ million}$$

- 6 C is correct. The pre- and post-merger HHI measures are 1,550 and 1,950, respectively. Not only is the HHI increasing by 400 points, but the industry concentration level also moves from moderately to highly concentrated. The probable action by the regulatory authorities is thus a challenge.

Company	Pre-Merger		Post-Merger		
	Market Share (%)	Market Share Squared	Company	Market Share (%)	Market Share Squared
1	25	625	1	25	625
2 (HiFly)	20	400	2 & 3	30	900
3 (Sky)	10	100	4	10	100
4	10	100	5	10	100
5	10	100	6	10	100
6	10	100	7	10	100
7	10	100	8	5	25
8	5	25			
HHI =		1,550	HHI =		

- 7** C is correct. The estimated stock value is \$41.57.

The value of High Tech = Total PV (present value) of free cash flows during the first four years + PV of the terminal value of High Tech at the end of the fourth year using the constant growth model.

$$\text{Total PV of free cash flows during the first four years} = 15/1.11 + 17/1.11^2 + 20/1.11^3 + 23/1.11^4 = \$57.09 \text{ million.}$$

Based on the constant growth model, the terminal value (TV) of High Tech at the end of the fourth year is  $TV = FCF \text{ at the end of the fifth year}/(k - g) = (23 \times 1.065)/(0.11 - 0.065) = \$544.33 \text{ million.}$

$$PV \text{ of the terminal value} = 544.33/1.11^4 = \$358.57 \text{ million.}$$

$$\text{Estimated value of High Tech} = 57.09 + 358.57 = \$415.66 \text{ million.}$$

$$\text{Estimated stock price} = 415.66 \text{ million}/10 \text{ million shares} = \$41.57.$$

- 8** B is correct. The estimated stock price is \$40.56.

$$\text{Total PV of free cash flows during the first four years} = 15/1.11 + 17/1.11^2 + 20/1.11^3 + 23/1.11^4 = \$57.09 \text{ million.}$$

Based on the cash flow multiple method, the terminal value of High Tech four years later =  $23 \times 23 = \$529 \text{ million.}$

$$PV \text{ of the terminal value} = 529/1.11^4 = \$348.47 \text{ million.}$$

Estimated value of High Tech = Total PV of free cash flows during the first four years + PV of the terminal value at the end of the fourth year =  $57.09 + 348.47 = \$405.55 \text{ million.}$

$$\text{Estimated stock price} = 405.55 \text{ million}/10 \text{ million shares} = \$40.56.$$

- 9** A is correct. The estimated value is \$35.21.

First, calculate the relative valuation ratios for the three comparable companies and their means.

Relative Valuation Ratio	Alpha	Neutron	Techno	Mean
P/E	14.62	13.69	20.24	16.18
P/S	2.18	1.62	2.81	2.20
P/BV	2.90	3.20	4.57	3.56

Then apply the means to the valuation variables for High Tech to get the estimated stock price for High Tech based on the comparable companies.

Valuation Variables	High Tech	Mean Multiple for Comparables	Estimated Stock Price
Current stock price	31.00		
Earnings/share	1.98	16.18	32.04
Sales/share	17.23	2.20	37.91
Book value/share	10.02	3.56	35.67

$$\text{The mean estimated stock price is } (32.04 + 37.91 + 35.67)/3 = \$35.21.$$

- 10** C is correct. The price is \$41.29.

The takeover premiums on three recent comparable takeovers are:

$$(28.00 - 24.90)/24.90 = 12.45\%$$

$$(52.00 - 43.20)/43.20 = 20.37\%$$

$$(34.50 - 29.00)/29.00 = 18.97\%$$

$$\text{Mean takeover premium} = 17.26\%$$

Using the comparable company approach, the stock price of High Tech if it is traded at the mean of the comparable company valuations is \$35.21.

Considering the mean takeover premium, the estimated fair acquisition price for High Tech is  $35.21 \times 1.1726 = \$41.29$ .

- 11** B is correct. The fair acquisition price is \$40.86. First, calculate the relative valuation ratios based on the acquisition price for the three comparable transactions and their means.

Relative Valuation Ratio	Quadrant	ProTech	Automator	Mean
P/E	20.00	24.76	14.68	19.81
P/S	2.65	2.55	2.17	2.46
P/BV	3.38	5.13	3.76	4.09

Then apply the means to the valuation variables for High Tech to get the estimated acquisition price for High Tech based on the comparable transactions.

Valuation Variables	High Tech	Mean Multiple Paid for Comparables	Estimated Acquisition Price
Earnings/share	1.98	19.81	39.22
Sales/share	17.23	2.46	42.39
Book value/share	10.02	4.09	40.98

The mean estimated acquisition stock price is  $(39.22 + 42.39 + 40.98)/3 = \$40.86$ .

- 12** A is correct. Both of Smith's statements are correct.

If there was a pre-announcement run-up in Quadrant's price because of speculation, the takeover premium should be computed based on the price prior to the run-up. Because the comparable transaction approach is based on the acquisition price, the takeover premium is implicitly recognized in this approach.

- 13** B is correct. Value is \$39.30.

Average P/E ratio is  $21.33 = (23.00 + 19.50 + 21.50)/3$

Value based on P/E ratio =  $21.33 (1.75) = 37.33$

Average P/B ratio is  $4.80 = (4.24 + 5.25 + 4.91)/3$

Value based on P/B ratio =  $4.80 (8.50) = 40.80$

Average P/CF ratio is  $12.43 = (12.60 + 11.40 + 13.30)/3$

Value based on P/CF ratio =  $12.43 (3.20) = 39.79$

Since Zin believes each valuation ratio is equally valid, value is a simple average of the three values.

Value =  $(37.33 + 40.80 + 39.79)/3 = 39.30$

- 14** C is correct. An equity carve-out involves sale of equity in a new legal entity to outsiders, and would thus result in a cash inflow for Moonbase. A spin-off or a split-off does not generate a cash flow to the firm.

- 15** B is correct. The first comment about the poison pill is correct, but the second comment is incorrect. Shareholders do not "put" their shares to the company; rather bondholders can exercise the put in the event of a hostile takeover.

Bondholders have the right to sell their bonds back to the target at a redemption price that is pre-specified in the bond indenture, typically at or above par value.

**16** C is correct. Statement 3 provides the most support for a strong governance rating. The statement describes the manner in which the audit committee should work. The other two statements do not support a strong governance rating as each casts doubt about the independence of the board from management's control.

**17** B is correct. The second policy is least likely to ensure effective contributions from the board. The board through self-assessment, and not management, should assess the board's performance.

**18** A is correct. As an independent director, without an interlocking relationship and with the expertise required, Steris would be eligible to serve on either of the two committees.

**19** A is correct.

$$\text{PV of first three cash flows: } 5/1.15 + 6/1.15^2 + 7/1.15^3 = 13.49$$

$$\text{Terminal value: } 7 \times 10 = 70$$

$$\text{PV of terminal value: } = 70/1.15^3 = 46.03$$

$$\text{Value} = 13.49 + 46.03 = 59.52$$

$$\text{Value per share} = 59.52/1.2 = 49.60$$

**20** B is correct.

$$\text{Terminal value at 5 percent: } 7(1.05)/(.15 - .05) = 73.50M$$

$$\text{Terminal value at 0 percent: } 7/1.15 = 46.67M$$

$$\text{Change in present value: } (46.67 - 73.50)/1.15^3 = -17.64$$

$$\text{Percentage change: } -17.64/61.8 = -28.5\%$$

**21** B is correct.

#### Step 1. Compute Valuation Ratios

Valuation Ratio	Alphatech	Betatech	Mean
P/E	36.00	30.00	33.00
P/S	2.25	2.00	2.125
P/BV	4.00	4.50	4.25

#### Step 2. Apply to Durtech's Variables

Valuation Ratio	Durtech	Mean Multiple	Estimated Stock Price
Earnings per share	1.00	33.00	33.00
Sales per share	16.00	2.125	34.00
Book value per share	8.00	4.25	34.00

$$\text{Step 3. Determine Mean Value: } (33 + 34 + 34)/3 = \$33.67 \text{ per share}$$

**22** B is correct. A comparable transaction sells for premium of  $55/44.4 - 1 = 23.9\%$ .

**23** C is correct. Omegatech's transaction P/E ratio:  $55/1.25 = 44$ . So estimated fair acquisition value per share is  $44 \times 1 = \$44.00$ .

**24** B is correct. Possible government action is based upon the change in the HHI and the post-merger HHI.

# Glossary

**Abandonment option** The ability to terminate a project at some future time if the financial results are disappointing.

**Abnormal earnings** See *residual income*.

**Abnormal return** The return on an asset in excess of the asset's required rate of return; the risk-adjusted return.

**Absolute convergence** The idea that developing countries, regardless of their particular characteristics, will eventually catch up with the developed countries and match them in per capita output.

**Absolute valuation model** A model that specifies an asset's intrinsic value.

**Absolute version of PPP** An extension of the law of one price whereby the prices of goods and services will not differ internationally once exchange rates are considered.

**Accounting estimates** Estimates used in calculating the value of assets or liabilities and in the amount of revenue and expense to allocate to a period. Examples of accounting estimates include, among others, the useful lives of depreciable assets, the salvage value of depreciable assets, product returns, warranty costs, and the amount of uncollectible receivables.

**Accumulated benefit obligation** The actuarial present value of benefits (whether vested or non-vested) attributed, generally by the pension benefit formula, to employee service rendered before a specified date and based on employee service and compensation (if applicable) before that date. The accumulated benefit obligation differs from the projected benefit obligation in that it includes no assumption about future compensation levels.

**Accuracy** The percentage of correctly predicted classes out of total predictions. It is an overall performance metric in classification problems.

**Acquirer** The company in a merger or acquisition that is acquiring the target.

**Acquiring company** The company in a merger or acquisition that is acquiring the target.

**Acquisition** The purchase of some portion of one company by another; the purchase may be for assets, a definable segment of another entity, or the purchase of an entire company.

**Activation function** A functional part of a neural network's node that transforms the total net input received into the final output of the node. The activation function operates like a light dimmer switch that decreases or increases the strength of the input.

**Active factor risk** The contribution to active risk squared resulting from the portfolio's different-than-benchmark exposures relative to factors specified in the risk model.

**Active return** The return on a portfolio minus the return on the portfolio's benchmark.

**Active risk** The standard deviation of active returns.

**Active risk squared** The variance of active returns; active risk raised to the second power.

**Active share** A measure of how similar a portfolio is to its benchmark. A manager who precisely replicates the benchmark will have an active share of zero; a manager with no holdings in common with the benchmark will have an active share of one.

**Active specific risk** The contribution to active risk squared resulting from the portfolio's active weights on individual assets as those weights interact with assets' residual risk.

**Adjusted funds from operations** Funds from operations (FFO) adjusted to remove any non-cash rent reported under straight-line rent accounting and to subtract maintenance-type capital expenditures and leasing costs, including leasing agents' commissions and tenants' improvement allowances.

**Adjusted present value** (APV) As an approach to valuing a company, the sum of the value of the company, assuming no use of debt, and the net present value of any effects of debt on company value.

**Adjusted R<sup>2</sup>** A measure of goodness-of-fit of a regression that is adjusted for degrees of freedom and hence does not automatically increase when another independent variable is added to a regression.

**Administrative regulations or administrative law** Rules issued by government agencies or other regulators.

**Advanced set** The reference interest rate is set at beginning of the settlement period.

**Advanced settled** An arrangement in which the settlement is made at the beginning of the settlement period.

**Agency costs** Costs associated with the conflict of interest present when a company is managed by non-owners. Agency costs result from the inherent conflicts of interest between managers and equity owners.

**Agency costs of equity** The smaller the stake that managers have in the company, the less is their share in bearing the cost of excessive perquisite consumption or not giving their best efforts in running the company.

**Agency issues** Conflicts of interest that arise when the agent in an agency relationship has goals and incentives that differ from the principal to whom the agent owes a fiduciary duty. Also called *agency problems* or *principal–agent problems*.

**Agglomerative clustering** A bottom-up hierarchical clustering method that begins with each observation being treated as its own cluster. The algorithm finds the two closest clusters, based on some measure of distance (similarity), and combines them into 1 new larger cluster. This process is repeated iteratively until all observations are clumped into a single large cluster.

**Allowance for loan losses** A balance sheet account; it is a contra asset account to loans.

**Alpha** The return on an asset in excess of the asset's required rate of return; the risk-adjusted return.

**American Depository Receipt** A negotiable certificate issued by a depositary bank that represents ownership in a non-US company's deposited equity (i.e., equity held in custody by the depositary bank in the company's home market).

**Analysis of variance (ANOVA)** The analysis of the total variability of a dataset (such as observations on the dependent variable in a regression) into components representing different sources of variation; with reference to regression, ANOVA provides the inputs for an *F*-test of the significance of the regression as a whole.

**Application programming interface (API)** A set of well-defined methods of communication between various software components and typically used for accessing external data.

**Arbitrage** 1) The simultaneous purchase of an undervalued asset or portfolio and sale of an overvalued but equivalent asset or portfolio, in order to obtain a riskless profit on the price differential. Taking advantage of a market inefficiency in a risk-free manner. 2) The condition in a financial market in which equivalent assets or combinations of assets sell for two different prices, creating an opportunity to profit at no risk with no commitment of money. In a well-functioning financial market, few arbitrage opportunities are possible. 3) A risk-free operation that earns an expected positive net profit but requires no net investment of money.

**Arbitrage-free models** Term structure models that project future interest rate paths that emanate from the existing term structure. Resulting prices are based on a no-arbitrage condition.

**Arbitrage-free valuation** An approach to valuation that determines security values that are consistent with the absence of arbitrage opportunities.

**Arbitrage opportunity** An opportunity to conduct an arbitrage; an opportunity to earn an expected positive net profit without risk and with no net investment of money.

**Arbitrage portfolio** The portfolio that exploits an arbitrage opportunity.

**Ask price** The price at which a trader will sell a specified quantity of a security. Also called *ask*, *offer price*, or *offer*.

**Asset-based approach** Approach that values a private company based on the values of the underlying assets of the entity less the value of any related liabilities.

**Asset-based valuation** An approach to valuing natural resource companies that estimates company value on the basis of the market value of the natural resources the company controls.

**Asset beta** The unlevered beta; reflects the business risk of the assets; the asset's systematic risk.

**Asset purchase** An acquisition in which the acquirer purchases the target company's assets and payment is made directly to the target company.

**Asymmetric information** The differential of information between corporate insiders and outsiders regarding the company's performance and prospects. Managers typically have more information about the company's performance and prospects than owners and creditors.

**At market** When a forward contract is established, the forward price is negotiated so that the market value of the forward contract on the initiation date is zero.

**Authorized participants** (APs) A special group of institutional investors who are authorized by the ETF issuer to participate in the creation/redemption process. APs are large broker/dealers, often market makers.

**Autocorrelation** The correlation of a time series with its own past values.

**Autoregressive model (AR)** A time series regressed on its own past values, in which the independent variable is a lagged value of the dependent variable.

**Backward integration** A merger involving the purchase of a target ahead of the acquirer in the value or production chain; for example, to acquire a supplier.

**Backward propagation** The process of adjusting weights in a neural network, to reduce total error of the network, by moving backward through the network's layers.

**Backwardation** A condition in futures markets in which the spot price exceeds the futures price; also, the condition in which the near-term (closer to expiration) futures contract price is higher than the longer-term futures contract price.

**Bag-of-words (BOW)** A collection of a distinct set of tokens from all the texts in a sample dataset. BOW does not capture the position or sequence of words present in the text.

**Bankruptcy** A declaration provided for by a country's laws that typically involves the establishment of a legal procedure that forces creditors to defer their claims.

**Base error** Model error due to randomness in the data.

**Basic earnings per share** (EPS) Net earnings available to common shareholders (i.e., net income minus preferred dividends) divided by the weighted average number of common shares outstanding during the period.

**Basis** The difference between the spot price and the futures price.

**Basis trade** A trade based on the pricing of credit in the bond market versus the price of the same credit in the CDS market. To execute a basis trade, go long the "underpriced" credit and short the "overpriced" credit. A profit is realized when the price of credit between the short and long position converges.

**Bear hug** A tactic used by acquirers to circumvent target management's objections to a proposed merger by submitting the proposal directly to the target company's board of directors.

**Benchmark value of the multiple** In using the method of comparables, the value of a price multiple for the comparison asset; when we have comparison assets (a group), the mean or median value of the multiple for the group of assets.

**Best ask** The offer to sell with the lowest ask price. Also called *best offer* or *inside ask*.

**Best bid** The offer to buy with the highest bid price. Also called the *inside bid*.

**Best offer** See *best ask*.

**Bias error** Describes the degree to which a model fits the training data. Algorithms with erroneous assumptions produce high bias error with poor approximation, causing underfitting and high in-sample error.

**Bid-ask spread** The ask price minus the bid price.

**Bid price** The price at which a trader will buy a specified quantity of a security. Also called *bid*.

**Bill-and-hold basis** Sales on a bill-and-hold basis involve selling products but not delivering those products until a later date.

**Blockage factor** An illiquidity discount that occurs when an investor sells a large amount of stock relative to its trading volume (assuming it is not large enough to constitute a controlling ownership).

**Bond indenture** A legal contract specifying the terms of a bond issue.

**Bond yield plus risk premium method** An estimate of the cost of common equity that is produced by summing the before-tax cost of debt and a risk premium that captures the

- additional yield** On a company's stock relative to its bonds. The additional yield is often estimated using historical spreads between bond yields and stock yields.
- Bonding costs** Costs borne by management to assure owners that they are working in the owners' best interest (e.g., implicit cost of non-compete agreements).
- Bonus issue of shares** A type of dividend in which a company distributes additional shares of its common stock to shareholders instead of cash.
- Book value** Shareholders' equity (total assets minus total liabilities) minus the value of preferred stock; common shareholders' equity.
- Book value of equity** Shareholders' equity (total assets minus total liabilities) minus the value of preferred stock; common shareholders' equity.
- Book value per share** The amount of book value (also called carrying value) of common equity per share of common stock, calculated by dividing the book value of shareholders' equity by the number of shares of common stock outstanding.
- Bootstrap aggregating (or bagging)** A technique whereby the original training data set is used to generate  $n$  new training data sets or bags of data. Each new bag of data is generated by random sampling with replacement from the initial training set.
- Bootstrapping** A statistical method for estimating a sample distribution based on the properties of an approximating distribution.
- Bottom-up approach** With respect to forecasting, an approach that usually begins at the level of the individual company or a unit within the company.
- Bottom-up investing** An approach to investing that focuses on the individual characteristics of securities rather than on macroeconomic or overall market forecasts.
- Breakup value** The value derived using a sum-of-the-parts valuation.
- Breusch-Pagan test** A test for conditional heteroskedasticity in the error term of a regression.
- Brokerage** The business of acting as agents for buyers or sellers, usually in return for commissions.
- Buy-side analysts** Analysts who work for investment management firms, trusts, and bank trust departments, and similar institutions.
- Buyback** A transaction in which a company buys back its own shares. Unlike stock dividends and stock splits, share repurchases use corporate cash.
- Callable bond** Bond that includes an embedded call option that gives the issuer the right to redeem the bond issue prior to maturity, typically when interest rates have fallen or when the issuer's credit quality has improved.
- Canceled shares** Shares that were issued, subsequently repurchased by the company, and then retired (cannot be reissued).
- Cannibalization** Cannibalization occurs when an investment takes customers and sales away from another part of the company.
- Cap rate** See *capitalization rate*.
- Capital charge** The company's total cost of capital in money terms.
- Capital deepening** An increase in the capital-to-labor ratio.
- Capital rationing** A capital rationing environment assumes that the company has a fixed amount of funds to invest.
- Capital structure** The mix of debt and equity that a company uses to finance its business; a company's specific mixture of long-term financing.
- Capitalization of earnings method** In the context of private company valuation, valuation model based on an assumption of a constant growth rate of free cash flow to the firm or a constant growth rate of free cash flow to equity.
- Capitalization rate** The divisor in the expression for the value of perpetuity. In the context of real estate, the divisor in the direct capitalization method of estimating value. The cap rate equals net operating income divided by value.
- Capitalized cash flow method** In the context of private company valuation, valuation model based on an assumption of a constant growth rate of free cash flow to the firm or a constant growth rate of free cash flow to equity. Also called *capitalized cash flow model*.
- Capitalized cash flow model** In the context of private company valuation, valuation model based on an assumption of a constant growth rate of free cash flow to the firm or a constant growth rate of free cash flow to equity. Also called *capitalized cash flow method*.
- Capitalized income method** In the context of private company valuation, valuation model based on an assumption of a constant growth rate of free cash flow to the firm or a constant growth rate of free cash flow to equity.
- Capped floater** Floating-rate bond with a cap provision that prevents the coupon rate from increasing above a specified maximum rate. It protects the issuer against rising interest rates.
- Carried interest** A share of any profits that is paid to the general partner (manager) of an investment partnership, such as a private equity or hedge fund, as a form of compensation designed to be an incentive to the manager to maximize performance of the investment fund.
- Carry arbitrage model** A no-arbitrage approach in which the underlying instrument is either bought or sold along with an opposite position in a forward contract.
- Carry benefits** Benefits that arise from owning certain underlyings; for example, dividends, foreign interest, and bond coupon payments.
- Carry costs** Costs that arise from owning certain underlyings. They are generally a function of the physical characteristics of the underlying asset and also the interest forgone on the funds tied up in the asset.
- Cash available for distribution** Funds from operations (FFO) adjusted to remove any non-cash rent reported under straight-line rent accounting and to subtract maintenance-type capital expenditures and leasing costs, including leasing agents' commissions and tenants' improvement allowances.
- Cash-generating unit** The smallest identifiable group of assets that generates cash inflows that are largely independent of the cash inflows of other assets or groups of assets.
- Cash offering** A merger or acquisition that is to be paid for with cash; the cash for the merger might come from the acquiring company's existing assets or from a debt issue.
- Cash settlement** A procedure used in certain derivative transactions that specifies that the long and short parties engage in the equivalent cash value of a delivery transaction.
- Catalyst** An event or piece of information that causes the marketplace to re-evaluate the prospects of a company.
- Categorical dependent variables** An alternative term for qualitative dependent variables.

**CDS spread** A periodic premium paid by the buyer to the seller that serves as a return over Libor required to protect against credit risk.

**Ceiling analysis** A systematic process of evaluating different components in the pipeline of model building. It helps to understand what part of the pipeline can potentially improve in performance by further tuning.

**Centroid** The center of a cluster formed using the K-means clustering algorithm.

**Chain rule of forecasting** A forecasting process in which the next period's value as predicted by the forecasting equation is substituted into the right-hand side of the equation to give a predicted value two periods ahead.

**Cheapest-to-deliver** The debt instrument that can be purchased and delivered at the lowest cost yet has the same seniority as the reference obligation.

**Classification and Regression Tree** A supervised machine learning technique that can be applied to predict either a categorical target variable, producing a classification tree, or a continuous target variable, producing a regression tree. CART is commonly applied to binary classification or regression.

**Clean surplus accounting** Accounting that satisfies the condition that all changes in the book value of equity other than transactions with owners are reflected in income. The bottom-line income reflects all changes in shareholders' equity arising from other than owner transactions. In the absence of owner transactions, the change in shareholders' equity should equal net income. No adjustments such as translation adjustments bypass the income statement and go directly to shareholders equity.

**Clean surplus relation** The relationship between earnings, dividends, and book value in which ending book value is equal to the beginning book value plus earnings less dividends, apart from ownership transactions.

**Clientele effect** The preference some investors have for shares that exhibit certain characteristics.

**Club convergence** The idea that only rich and middle-income countries sharing a set of favorable attributes (i.e., are members of the "club") will converge to the income level of the richest countries.

**Cluster** A subset of observations from a data set such that all the observations within the same cluster are deemed "similar."

**Clustering** The sorting of observations into groups (clusters) such that observations in the same cluster are more similar to each other than they are to observations in other clusters.

**Cobb-Douglas production function** A function of the form  $Y = K^\alpha L^{1-\alpha}$  relating output (Y) to labor (L) and capital (K) inputs.

**Cointegrated** Describes two time series that have a long-term financial or economic relationship such that they do not diverge from each other without bound in the long run.

**Collateral return** The component of the total return on a commodity futures position attributable to the yield for the bonds or cash used to maintain the futures position. Also called *collateral yield*.

**Collection frequency (CF)** The number of times a given word appears in the whole corpus (i.e., collection of sentences) divided by the total number of words in the corpus.

**Commercial real estate properties** Income-producing real estate properties, properties purchased with the intent to let, lease, or rent (in other words, produce income).

**Commodity swap** A type of swap involving the exchange of payments over multiple dates as determined by specified reference prices or indexes relating to commodities.

**Common size statements** Financial statements in which all elements (accounts) are stated as a percentage of a key figure such as revenue for an income statement or total assets for a balance sheet.

**Company fundamental factors** Factors related to the company's internal performance, such as factors relating to earnings growth, earnings variability, earnings momentum, and financial leverage.

**Company share-related factors** Valuation measures and other factors related to share price or the trading characteristics of the shares, such as earnings yield, dividend yield, and book-to-market value.

**Comparables** Assets used as benchmarks when applying the method of comparables to value an asset. Also called *comps*, *guideline assets*, or *guideline companies*.

**Compiled financial statements** Financial statements that are not accompanied by an auditor's opinion letter.

**Complexity** A term referring to the number of features, terms, or branches in a model and to whether the model is linear or non-linear (non-linear is more complex).

**Composite variable** A variable that combines two or more variables that are statistically strongly related to each other.

**Comprehensive income** All changes in equity other than contributions by, and distributions to, owners; income under clean surplus accounting; includes all changes in equity during a period except those resulting from investments by owners and distributions to owners; comprehensive income equals net income plus other comprehensive income.

**Comps** Assets used as benchmarks when applying the method of comparables to value an asset.

**Concentrated ownership** Ownership structure consisting of an individual shareholder or a group (controlling shareholders) with the ability to exercise control over the corporation.

**Conditional convergence** The idea that convergence of per capita income is conditional on the countries having the same savings rate, population growth rate, and production function.

**Conditional heteroskedasticity** Heteroskedasticity in the error variance that is correlated with the values of the independent variable(s) in the regression.

**Conditional VaR (CVaR)** The average loss conditional on exceeding the VaR cutoff; sometimes referred to as the *expected tail loss* or *expected shortfall*.

**Confusion matrix** A grid used for error analysis in classification problems; it presents values for four evaluation metrics including true positive (TP), false positive (FP), true negative (TN), and false negative (FN).

**Conglomerate discount** The discount possibly applied by the market to the stock of a company operating in multiple, unrelated businesses.

**Conglomerate merger** A merger involving companies that are in unrelated businesses.

**Consolidation** The combining of the results of operations of subsidiaries with the parent company to present financial statements as if they were a single economic unit. The assets, liabilities, revenues and expenses of the subsidiaries are combined with those of the parent company, eliminating intercompany transactions.

**Constant dividend payout ratio policy** A policy in which a constant percentage of net income is paid out in dividends.

**Constant returns to scale** The condition that if all inputs into the production process are increased by a given percentage, then output rises by that same percentage.

**Contango** A condition in futures markets in which the spot price is lower than the futures price; also, the condition in which the near-term (closer to expiration) futures contract price is lower than the longer-term futures contract price.

**Contingent consideration** Potential future payments to the seller that are contingent on the achievement of certain agreed-on occurrences.

**Continuing earnings** Earnings excluding nonrecurring components. Also referred to as *core earnings*, *persistent earnings*, or *underlying earnings*.

**Continuing residual income** Residual income after the forecast horizon.

**Continuing value** The analyst's estimate of a stock's value at a particular point in the future.

**Control premium** An increment or premium to value associated with a controlling ownership interest in a company.

**Conventional cash flow** A conventional cash flow pattern is one with an initial outflow followed by a series of inflows.

**Convergence** The property of forward and futures contracts in which the derivative price becomes the spot price at expiration of the derivative.

**Conversion period** For a convertible bond, the period during which bondholders have the right to convert their bonds into shares.

**Conversion price** For a convertible bond, the price per share at which the bond can be converted into shares.

**Conversion ratio** For a convertible bond, the number of shares of common stock that a bondholder receives from converting the bond into shares.

**Conversion value** For a convertible bond, the value of the bond if it is converted at the market price of the shares. Also called *parity value*.

**Convertible bond** Bond with an embedded conversion option that gives the bondholder the right to convert their bonds into the issuer's common stock during a pre-determined period at a pre-determined price.

**Convexity** A measure of how interest rate sensitivity changes with a change in interest rates.

**Core earnings** Earnings excluding nonrecurring components. Also referred to as *continuing earnings*, *persistent earnings*, or *underlying earnings*.

**Corporate raider** A person or organization seeking to profit by acquiring a company and reselling it, or seeking to profit from the takeover attempt itself (e.g., greenmail).

**Corpus** A collection of text data in any form, including list, matrix, or data table forms.

**Cost approach** Approach that values a private company based on the values of the underlying assets of the entity less the value of any related liabilities. In the context of real estate, this approach estimates the value of a property based on what it would cost to buy the land and construct a new property on the site that has the same utility or functionality as the property being appraised.

**Cost of debt** The cost of debt financing to a company, such as when it issues a bond or takes out a bank loan.

**Cost of equity** The required rate of return on common stock.

**Covariance stationary** Describes a time series when its expected value and variance are constant and finite in all periods and when its covariance with itself for a fixed number of periods in the past or future is constant and finite in all periods.

**Covered bonds** A senior debt obligation of a financial institution that gives recourse to the originator/issuer as well as a predetermined underlying collateral pool.

**Covered interest rate parity** The relationship among the spot exchange rate, the forward exchange rate, and the interest rates in two currencies that ensures that the return on a hedged (i.e., covered) foreign risk-free investment is the same as the return on a domestic risk-free investment. Also called *interest rate parity*.

**Cox-Ingersoll-Ross model** A partial equilibrium term structure model that assumes interest rates are mean reverting and interest rate volatility is directly related to the level of interest rates.

**Creation basket** The list of securities (and share amounts) the authorized participant (AP) must deliver to the ETF manager in exchange for ETF shares. The creation basket is published each business day.

**Creation/redemption** The process in which ETF shares are created or redeemed by authorized participants transacting with the ETF issuer.

**Creation units** Large blocks of ETF shares transacted between the authorized participant (AP) and the ETF manager that are usually but not always equal to 50,000 shares of the ETF.

**Credit correlation** The correlation of credits contained in an index CDS.

**Credit curve** The credit spreads for a range of maturities of a company's debt; applies to non-government borrowers and incorporates credit risk into each rate.

**Credit default swap** A derivative contract between two parties in which the buyer makes a series of cash payments to the seller and receives a promise of compensation for credit losses resulting from the default.

**Credit derivative** A derivative instrument in which the underlying is a measure of the credit quality of a borrower.

**Credit event** The outcome that triggers a payment from the credit protection seller to the credit protection buyer.

**Credit protection buyer** One party to a credit default swap; the buyer makes a series of cash payments to the seller and receives a promise of compensation for credit losses resulting from the default.

**Credit protection seller** One party to a credit default swap; the buyer makes a series of cash payments to the seller and receives a promise of compensation for credit losses resulting from the default.

**Credit risk** The risk that the borrower will not repay principal and interest. Also called *default risk*.

**Credit valuation adjustment** The value of the credit risk of a bond in present value terms.

**Cross-validation** A technique for estimating out-of-sample error directly by determining the error in validation samples.

**Current exchange rate** For accounting purposes, the spot exchange rate on the balance sheet date.

**Current rate method** Approach to translating foreign currency financial statements for consolidation in which all assets and liabilities are translated at the current exchange rate. The current rate method is the prevalent method of translation.

**Curvature** One of the three factors (the other two are level and steepness) that empirically explain most of the changes in the shape of the yield curve. A shock to the curvature factor affects mid-maturity interest rates, resulting in the term structure becoming either more or less hump-shaped.

**Curve trade** Buying a CDS of one maturity and selling a CDS on the same reference entity with a different maturity.

**Cyclical businesses** Businesses with high sensitivity to business- or industry-cycle influences.

**Data mining** The practice of determining a model by extensive searching through a dataset for statistically significant patterns.

**Data preparation (cleansing)** The process of examining, identifying, and mitigating (i.e., cleansing) errors in raw data.

**Data wrangling (preprocessing)** This task performs transformations and critical processing steps on cleansed data to make the data ready for ML model training (i.e., preprocessing), and includes dealing with outliers, extracting useful variables from existing data points, and scaling the data.

**"Dead-hand" provision** A poison pill provision that allows for the redemption or cancellation of a poison pill provision only by a vote of continuing directors (generally directors who were on the target company's board prior to the takeover attempt).

**Debt ratings** An objective measure of the quality and safety of a company's debt based upon an analysis of the company's ability to pay the promised cash flows, as well as an analysis of any indentures.

**Decision rule** With respect to hypothesis testing, the rule according to which the null hypothesis will be rejected or not rejected; involves the comparison of the test statistic to rejection point(s).

**Deep learning** Algorithms based on complex neural networks, ones with many hidden layers (more than 3), that address highly complex tasks, such as image classification, face recognition, speech recognition, and natural language processing.

**Deep learning nets** Algorithms based on complex neural networks, ones with many hidden layers (more than 3), that address highly complex tasks, such as image classification, face recognition, speech recognition, and natural language processing.

**Default risk** See *credit risk*.

**Defined benefit pension plans** Plan in which the company promises to pay a certain annual amount (defined benefit) to the employee after retirement. The company bears the investment risk of the plan assets.

**Defined contribution pension plans** Individual accounts to which an employee and typically the employer makes contributions, generally on a tax-advantaged basis. The amounts of contributions are defined at the outset, but the future value of the benefit is unknown. The employee bears the investment risk of the plan assets.

**Definition of value** A specification of how "value" is to be understood in the context of a specific valuation.

**Definitive merger agreement** A contract signed by both parties to a merger that clarifies the details of the transaction, including the terms, warranties, conditions, termination details, and the rights of all parties.

**Delay costs** Implicit trading costs that arise from the inability to complete desired trades immediately. Also called *slippage*.

**Delta** The relationship between the option price and the underlying price, which reflects the sensitivity of the price of the option to changes in the price of the underlying. Delta is a good approximation of how an option price will change for a small change in the stock.

**Dendrogram** A type of tree diagram used for visualizing a hierarchical cluster analysis—it highlights the hierarchical relationships among the clusters.

**Dependent variable** The variable whose variation about its mean is to be explained by the regression; the left-hand-side variable in a regression equation.

**Depository Trust and Clearinghouse Corporation** A US-headquartered entity providing post-trade clearing, settlement, and information services.

**Depreciated replacement cost** In the context of real estate, the replacement cost of a building adjusted different types of depreciation.

**Descriptive statistics** The study of how data can be summarized effectively.

**Diluted earnings per share** (diluted EPS) Net income, minus preferred dividends, divided by the weighted average number of common shares outstanding considering all dilutive securities (e.g., convertible debt and options); the EPS that would result if all dilutive securities were converted into common shares.

**Dilution** A reduction in proportional ownership interest as a result of the issuance of new shares.

**Dimension reduction** A set of techniques for reducing in the number of features in a dataset while retaining variation across observations to preserve the information contained in that variation.

**Diminishing marginal productivity** When each additional unit of an input, keeping the other inputs unchanged, increases output by a smaller increment.

**Direct capitalization method** In the context of real estate, this method estimates the value of an income-producing property based on the level and quality of its net operating income.

**Discount** To reduce the value of a future payment in allowance for how far away it is in time; to calculate the present value of some future amount. Also, the amount by which an instrument is priced below its face value.

**Discount factor** The present value or price of a risk-free single-unit payment when discounted using the appropriate spot rate.

**Discount for lack of control** An amount or percentage deducted from the pro rata share of 100 percent of the value of an equity interest in a business to reflect the absence of some or all of the powers of control.

**Discount for lack of marketability** An amount of percentage deducted from the value of an ownership interest to reflect the relative absence of marketability.

**Discount function** Discount factors for the range of all possible maturities. The spot curve can be derived from the discount function and vice versa.

**Discount rate** Any rate used in finding the present value of a future cash flow.

**Discounted abnormal earnings model** A model of stock valuation that views intrinsic value of stock as the sum of book value per share plus the present value of the stock's expected future residual income per share.

**Discounted cash flow (DCF) analysis** In the context of merger analysis, it is an estimate of a target company's value found by discounting the company's expected future free cash flows to the present.

**Discounted cash flow method** Income approach that values an asset based on estimates of future cash flows discounted to present value by using a discount rate reflective of the risks associated with the cash flows. In the context of real

## Glossary

- estate**, this method estimates the value of an income-producing property based by discounting future projected cash flows.
- Discounted cash flow model** A model of intrinsic value that views the value of an asset as the present value of the asset's expected future cash flows.
- Discriminant analysis** A multivariate classification technique used to discriminate between groups, such as companies that either will or will not become bankrupt during some time frame.
- Dispersed ownership** Ownership structure consisting of many shareholders, none of which have the ability to individually exercise control over the corporation.
- Diversified REITs** REITs that own and operate in more than one type of property; they are more common in Europe and Asia than in the United States.
- Divestiture** The sale, liquidation, or spin-off of a division or subsidiary.
- Dividend** A distribution paid to shareholders based on the number of shares owned.
- Dividend coverage ratio** The ratio of net income to dividends.
- Dividend discount model** (DDM) A present value model of stock value that views the intrinsic value of a stock as present value of the stock's expected future dividends.
- Dividend displacement of earnings** The concept that dividends paid now displace earnings in all future periods.
- Dividend imputation tax system** A taxation system which effectively assures that corporate profits distributed as dividends are taxed just once and at the shareholder's tax rate.
- Dividend payout ratio** The ratio of cash dividends paid to earnings for a period.
- Dividend policy** The strategy a company follows with regard to the amount and timing of dividend payments.
- Dividend rate** The annualized amount of the most recent dividend.
- Dividend yield** Annual dividends per share divided by share price.
- Divisive clustering** A top-down hierarchical clustering method that starts with all observations belonging to a single large cluster. The observations are then divided into two clusters based on some measure of distance (similarity). The algorithm then progressively partitions the intermediate clusters into smaller ones until each cluster contains only 1 observation.
- Document frequency (DF)** The number of documents (texts) that contain a particular token divided by the total number of documents. It is the simplest feature selection method and often performs well when many thousands of tokens are present.
- Document term matrix (DTM)** A matrix where each row belongs to a document (or text file), and each column represents a token (or term). The number of rows is equal to the number of documents (or text files) in a sample text dataset. The number of columns is equal to the number of tokens from the BOW built using all the documents in the sample dataset. The cells typically contain the counts of the number of times a token is present in each document.
- Dominance** An arbitrage opportunity when a financial asset with a risk-free payoff in the future must have a positive price today.
- Double taxation system** Corporate earnings are taxed twice when paid out as dividends. First, corporate pretax earnings are taxed regardless of whether they will be distributed as dividends or retained at the corporate level. Second, dividends are taxed again at the individual shareholder level.
- DOWNREIT** A variation of the UPREIT structure under which the REIT owns more than one partnership and may own properties at both the REIT level and the partnership level.
- Downstream** A transaction between two related companies, an investor company (or a parent company) and an associate company (or a subsidiary) such that the investor company records a profit on its income statement. An example is a sale of inventory by the investor company to the associate or by a parent to a subsidiary company.
- Dual-class shares** Shares that grant one share class superior or even sole voting rights, whereas the other share class has inferior or no voting rights.
- Due diligence** Investigation and analysis in support of a recommendation; the failure to exercise due diligence may sometimes result in liability according to various securities laws.
- Dummy variable** A type of qualitative variable that takes on a value of 1 if a particular condition is true and 0 if that condition is false.
- Duration** A measure of the approximate sensitivity of a security to a change in interest rates (i.e., a measure of interest rate risk).
- Dutch disease** A situation in which currency appreciation driven by strong export demand for resources makes other segments of the economy (particularly manufacturing) globally uncompetitive.
- Earnings surprise** The difference between reported EPS and expected EPS. Also referred to as *unexpected earnings*.
- Earnings yield** EPS divided by price; the reciprocal of the P/E ratio.
- Economic obsolescence** In the context of real estate, a reduction in value due to current economic conditions.
- Economic profit** See *residual income*.
- Economic sectors** Large industry groupings.
- Economic value added** (EVA<sup>®</sup>) A commercial implementation of the residual income concept; the computation of EVA<sup>®</sup> is the net operating profit after taxes minus the cost of capital, where these inputs are adjusted for a number of items.
- Economies of scale** A situation in which average costs per unit of good or service produced fall as volume rises. In reference to mergers, the savings achieved through the consolidation of operations and elimination of duplicate resources.
- Edwards–Bell–Ohlson model** A model of stock valuation that views intrinsic value of stock as the sum of book value per share plus the present value of the stock's expected future residual income per share.
- Effective convexity** Sensitivity of duration to changes in interest rates.
- Effective duration** Sensitivity of the bond's price to a 100 bps parallel shift of the benchmark yield curve, assuming no change in the bond's credit spread.
- Effective spread** Two times the difference between the execution price and the midpoint of the market quote at the time an order is entered.
- Eigenvalue** A measure that gives the proportion of total variance in the initial dataset that is explained by each eigenvector.

**Eigenvector** A vector that defines new mutually uncorrelated composite variables that are linear combinations of the original features.

**Embedded options** Contingency provisions found in a bond's indenture or offering circular representing rights that enable their holders to take advantage of interest rate movements. They can be exercised by the issuer, by the bondholder, or automatically depending on the course of interest rates.

**Ensemble learning** A technique of combining the predictions from a collection of models to achieve a more accurate prediction.

**Ensemble method** The method of combining multiple learning algorithms, as in ensemble learning.

**Enterprise value** (EV) Total company value (the market value of debt, common equity, and preferred equity) minus the value of cash and investments.

**Enterprise value multiple** A valuation multiple that relates the total market value of all sources of a company's capital (net of cash) to a measure of fundamental value for the entire company (such as a pre-interest earnings measure).

**Entry price** The price paid to acquire an asset.

**Equilibrium** The condition in which supply equals demand.

**Equity carve-out** A form of restructuring that involves the creation of a new legal entity and the sale of equity in it to outsiders.

**Equity charge** The estimated cost of equity capital in money terms.

**Equity REIT** A REIT that owns, operates, and/or selectively develops income-producing real estate.

**Equity swap** A swap transaction in which at least one cash flow is tied to the return on an equity portfolio position, often an equity index.

**Error autocorrelation** The autocorrelation of the error term.

**Error term** The portion of the dependent variable that is not explained by the independent variable(s) in the regression.

**ESG integration** The implementation of qualitative and quantitative ESG factors in traditional security and industry analysis.

**Estimated parameters** With reference to a regression analysis, the estimated values of the population intercept and population slope coefficient(s) in a regression.

**Ex ante tracking error** A measure of the degree to which the performance of a given investment portfolio might be expected to deviate from its benchmark; also known as *relative VaR*.

**Ex ante version of PPP** The hypothesis that expected changes in the spot exchange rate are equal to expected differences in national inflation rates. An extension of relative purchasing power parity to expected future changes in the exchange rate.

**Ex-dividend** Trading ex-dividend refers to shares that no longer carry the right to the next dividend payment.

**Ex-dividend date** The first date that a share trades without (i.e., "ex") the right to receive the declared dividend for the period.

**Excess earnings method** Income approach that estimates the value of all intangible assets of the business by capitalizing future earnings in excess of the estimated return requirements associated with working capital and fixed assets.

**Exchange ratio** The number of shares that target stockholders are to receive in exchange for each of their shares in the target company.

**Exercise date** The date when employees actually exercise stock options and convert them to stock.

**Exercise value** The value of an option if it were exercised. Also sometimes called *intrinsic value*.

**Exit price** The price received to sell an asset or paid to transfer a liability.

**Expanded CAPM** An adaptation of the CAPM that adds to the CAPM a premium for small size and company-specific risk.

**Expectations approach** A procedure for obtaining the value of an option derived from discounting at the risk-free rate its expected future payoff based on risk neutral probabilities.

**Expected exposure** The projected amount of money an investor could lose if an event of default occurs, before factoring in possible recovery.

**Expected holding-period return** The expected total return on an asset over a stated holding period; for stocks, the sum of the expected dividend yield and the expected price appreciation over the holding period.

**Expected loss** The probability of default multiplied by the loss given default; the full amount owed minus the expected recovery.

**Expected shortfall** See *conditional VaR*.

**Expected tail loss** See *conditional VaR*.

**Exploratory data analysis (EDA)** The preliminary step in data exploration, where graphs, charts, and other visualizations (heat maps and word clouds) as well as quantitative methods (descriptive statistics and central tendency measures) are used to observe and summarize data.

**Exposure to foreign exchange risk** The risk of a change in value of an asset or liability denominated in a foreign currency due to a change in exchange rates.

**Extendible bond** Bond with an embedded option that gives the bondholder the right to keep the bond for a number of years after maturity, possibly with a different coupon.

**External growth** Company growth in output or sales that is achieved by buying the necessary resources externally (i.e., achieved through mergers and acquisitions).

**Extra dividend** A dividend paid by a company that does not pay dividends on a regular schedule, or a dividend that supplements regular cash dividends with an extra payment.

**F1 score** The harmonic mean of precision and recall. F1 score is a more appropriate overall performance metric (than accuracy) when there is unequal class distribution in the dataset and it is necessary to measure the equilibrium of precision and recall.

**Factor** A common or underlying element with which several variables are correlated.

**Factor betas** An asset's sensitivity to a particular factor; a measure of the response of return to each unit of increase in a factor, holding all other factors constant.

**Factor portfolio** See *pure factor portfolio*.

**Factor price** The expected return in excess of the risk-free rate for a portfolio with a sensitivity of 1 to one factor and a sensitivity of 0 to all other factors.

**Factor risk premium** The expected return in excess of the risk-free rate for a portfolio with a sensitivity of 1 to one factor and a sensitivity of 0 to all other factors. Also called *factor price*.

**Factor sensitivity** See *factor betas*.

**Failure to pay** When a borrower does not make a scheduled payment of principal or interest on any outstanding obligations after a grace period.

**Fair market value** The market price of an asset or liability that trades regularly.

**Fair value** The amount at which an asset (or liability) could be bought (or incurred) or sold (or settled) in a current transaction between willing parties, that is, other than in a forced or liquidation sale; as defined in IFRS and US GAAP, the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date.

**Feature engineering** A process of creating new features by changing or transforming existing features.

**Feature selection** A process whereby only pertinent features from the dataset are selected for model training. Selecting fewer features decreases model complexity and training time.

**Features** The independent variables ( $X$ 's) in a labeled dataset.

**Financial contagion** A situation where financial shocks spread from their place of origin to other locales. In essence, a faltering economy infects other, healthier economies.

**Financial distress** Heightened uncertainty regarding a company's ability to meet its various obligations because of lower or negative earnings.

**Financial transaction** A purchase involving a buyer having essentially no material synergies with the target (e.g., the purchase of a private company by a company in an unrelated industry or by a private equity firm would typically be a financial transaction).

**First-differencing** A transformation that subtracts the value of the time series in period  $t - 1$  from its value in period  $t$ .

**First-order serial correlation** Correlation between adjacent observations in a time series.

**Fitted parameters** With reference to a regression analysis, the estimated values of the population intercept and population slope coefficient(s) in a regression.

**Fitting curve** A curve which shows in- and out-of-sample error rates ( $E_{in}$  and  $E_{out}$ ) on the y-axis plotted against model complexity on the x-axis.

**Fixed price tender offer** Offer made by a company to repurchase a specific number of shares at a fixed price that is typically at a premium to the current market price.

**Fixed-rate perpetual preferred stock** Nonconvertible, non-callable preferred stock with a specified dividend rate that has a claim on earnings senior to the claim of common stock, and no maturity date.

**Flip-in pill** A poison pill takeover defense that dilutes an acquirer's ownership in a target by giving other existing target company shareholders the right to buy additional target company shares at a discount.

**Flip-over pill** A poison pill takeover defense that gives target company shareholders the right to purchase shares of the acquirer at a significant discount to the market price, which has the effect of causing dilution to all existing acquiring company shareholders.

**Float** Amounts collected as premium and not yet paid out as benefits.

**Floored floater** Floating-rate bond with a floor provision that prevents the coupon rate from decreasing below a specified minimum rate. It protects the investor against declining interest rates.

**Flotation cost** Fees charged to companies by investment bankers and other costs associated with raising new capital.

**Forced conversion** For a convertible bond, when the issuer calls the bond and forces bondholders to convert their bonds into shares, which typically happens when the underlying share price increases above the conversion price.

**Foreign currency transactions** Transactions that are denominated in a currency other than a company's functional currency.

**Forward curve** The term structure of forward rates for loans made on a specific initiation date.

**Forward dividend yield** A dividend yield based on the anticipated dividend during the next 12 months.

**Forward integration** A merger involving the purchase of a target that is farther along the value or production chain; for example, to acquire a distributor.

**Forward P/E** A P/E calculated on the basis of a forecast of EPS; a stock's current price divided by next year's expected earnings.

**Forward price** The fixed price or rate at which the transaction scheduled to occur at the expiration of a forward contract will take place. This price is agreed to at the initiation date of the contract.

**Forward pricing model** The model that describes the valuation of forward contracts.

**Forward propagation** The process of adjusting weights in a neural network, to reduce total error of the network, by moving forward through the network's layers.

**Forward rate** An interest rate that is determined today for a loan that will be initiated in a future time period.

**Forward rate agreement** A forward contract calling for one party to make a fixed interest payment and the other to make an interest payment at a rate to be determined at the contract expiration.

**Forward rate model** The forward pricing model expressed in terms of spot and forward interest rates.

**Forward rate parity** The proposition that the forward exchange rate is an unbiased predictor of the future spot exchange rate.

**Forward value** The monetary value of an existing forward contract.

**Franking credit** A tax credit received by shareholders for the taxes that a corporation paid on its distributed earnings.

**Free cash flow** The actual cash that would be available to the company's investors after making all investments necessary to maintain the company as an ongoing enterprise (also referred to as free cash flow to the firm); the internally generated funds that can be distributed to the company's investors (e.g., shareholders and bondholders) without impairing the value of the company.

**Free cash flow hypothesis** The hypothesis that higher debt levels discipline managers by forcing them to make fixed debt service payments and by reducing the company's free cash flow.

**Free cash flow method** Income approach that values an asset based on estimates of future cash flows discounted to present value by using a discount rate reflective of the risks associated with the cash flows.

**Free cash flow to equity** The cash flow available to a company's common shareholders after all operating expenses, interest, and principal payments have been made, and necessary investments in working and fixed capital have been made.

**Free cash flow to equity model** A model of stock valuation that views a stock's intrinsic value as the present value of expected future free cash flows to equity.

**Free cash flow to the firm** The cash flow available to the company's suppliers of capital after all operating expenses (including taxes) have been paid and necessary investments in working and fixed capital have been made.

**Free cash flow to the firm model** A model of stock valuation that views the value of a firm as the present value of expected future free cash flows to the firm.

**Frequency analysis** The process of quantifying how important tokens are in a sentence and in the corpus as a whole. It helps in filtering unnecessary tokens (or features).

**Friendly transaction** A potential business combination that is endorsed by the managers of both companies.

**Functional currency** The currency of the primary economic environment in which an entity operates.

**Functional obsolescence** In the context of real estate, a reduction in value due to a design that differs from that of a new building constructed for the intended use of the property.

**Fundamental factor models** A multifactor model in which the factors are attributes of stocks or companies that are important in explaining cross-sectional differences in stock prices.

**Fundamentals** Economic characteristics of a business such as profitability, financial strength, and risk.

**Funds available for distribution** Funds from operations (FFO) adjusted to remove any non-cash rent reported under straight-line rent accounting and to subtract maintenance-type capital expenditures and leasing costs, including leasing agents' commissions and tenants' improvement allowances.

**Funds from operations** Net income (computed in accordance with generally accepted accounting principles) *plus* 1) gains and losses from sales of properties and 2) depreciation and amortization.

**Futures price** The price at which the parties to a futures contract agree to exchange the underlying (or cash). In commodity markets, the price agreed on to deliver or receive a defined quantity (and often quality) of a commodity at a future date.

**Futures value** The monetary value of an existing futures contract.

**FX carry trade** An investment strategy that involves taking long positions in high-yield currencies and short positions in low-yield currencies.

**Gamma** A measure of how sensitive an option's delta is to a change in the underlying. The change in a given instrument's delta for a given small change in the underlying's value, holding everything else constant.

**Generalize** When a model retains its explanatory power when predicting out-of-sample (i.e., using new data).

**Generalized least squares** A regression estimation technique that addresses heteroskedasticity of the error term.

**Going-concern assumption** The assumption that the business will maintain its business activities into the foreseeable future.

**Going-concern value** A business's value under a going-concern assumption.

**Goodwill** An intangible asset that represents the excess of the purchase price of an acquired company over the value of the net identifiable assets acquired.

**Grant date** The day that stock options are granted to employees.

**Green bond** Bonds in which the proceeds are designated by issuers to fund a specific project or portfolio of projects that have environmental or climate benefits.

**Greenmail** The purchase of the accumulated shares of a hostile investor by a company that is targeted for takeover by that investor, usually at a substantial premium over market price.

**Greenwashing** The risk that a green bond's proceeds are not actually used for a beneficial environmental or climate-related project.

**Grid search** A method of systematically training a model by using various combinations of hyperparameter values, cross validating each model, and determining which combination of hyperparameter values ensures the best model performance.

**Gross domestic product** A money measure of the goods and services produced within a country's borders over a stated time period.

**Gross lease** A lease under which the tenant pays a gross rent to the landlord who is responsible for all operating costs, utilities, maintenance expenses, and real estate taxes relating to the property.

**Ground truth** The known outcome (i.e., target variable) of each observation in a labelled dataset.

**Growth accounting equation** The production function written in the form of growth rates. For the basic Cobb–Douglas production function, it states that the growth rate of output equals the rate of technological change plus  $\alpha$  times the growth rate of capital plus  $(1 - \alpha)$  times the growth rate of labor.

**Growth capital expenditures** Capital expenditures needed for expansion.

**Growth option** The ability to make additional investments in a project at some future time if the financial results are strong. Also called *expansion option*.

**Guideline assets** Assets used as benchmarks when applying the method of comparables to value an asset.

**Guideline companies** Assets used as benchmarks when applying the method of comparables to value an asset.

**Guideline public companies** Public-company comparables for the company being valued.

**Guideline public company method** A variation of the market approach; establishes a value estimate based on the observed multiples from trading activity in the shares of public companies viewed as reasonably comparable to the subject private company.

**Guideline transactions method** A variation of the market approach; establishes a value estimate based on pricing multiples derived from the acquisition of control of entire public or private companies that were acquired.

**Harmonic mean** A type of weighted mean computed by averaging the reciprocals of the observations, then taking the reciprocal of that average.

**Hazard rate** The probability that an event will occur, given that it has not already occurred.

**Health care REITs** REITs that invest in skilled nursing facilities (nursing homes), assisted living and independent residential facilities for retired persons, hospitals, medical office buildings, or rehabilitation centers.

**Herfindahl–Hirschman Index (HHI)** A measure of market concentration that is calculated by summing the squared market shares for competing companies in an industry; high HHI readings or mergers that would result in large HHI increases are more likely to result in regulatory challenges.

**Heteroskedastic** With reference to the error term of regression, having a variance that differs across observations.

**Heteroskedasticity** The property of having a nonconstant variance; refers to an error term with the property that its variance differs across observations.

**Heteroskedasticity-consistent standard errors** Standard errors of the estimated parameters of a regression that correct for the presence of heteroskedasticity in the regression's error term.

**Hierarchical clustering** An iterative unsupervised learning procedure used for building a hierarchy of clusters.

**Historical exchange rates** For accounting purposes, the exchange rates that existed when the assets and liabilities were initially recorded.

**Historical simulation method** The application of historical price changes to the current portfolio.

**Ho-Lee model** The first arbitrage-free term structure model. The model is calibrated to market data and uses a binomial lattice approach to generate a distribution of possible future interest rates.

**Holding period return** The return that an investor earns during a specified holding period; a synonym for total return.

**Holdout samples** Data samples that are not used to train a model.

**Homoskedasticity** The property of having a constant variance; refers to an error term that is constant across observations.

**Horizontal merger** A merger involving companies in the same line of business, usually as competitors.

**Horizontal ownership** Companies with mutual business interests (e.g., key customers or suppliers) that have cross-holding share arrangements with each other.

**Hostile transaction** An attempt to acquire a company against the wishes of the target's managers.

**Hotel REITs** REITs that own hotel properties but, similar to health care REITs, in many countries they must refrain from operating their properties themselves to maintain their tax-advantaged REIT status.

**Human capital** The accumulated knowledge and skill that workers acquire from education, training, or life experience.

**Hybrid approach** With respect to forecasting, an approach that combines elements of both top-down and bottom-up analysis.

**Hybrid REITs** REITs that own and operate income-producing real estate and invest in mortgages as well; REITs that have positions in both real estate assets and real estate debt.

**Hyperparameter** A parameter whose value must be set by the researcher before learning begins.

**I-spreads** Shortened form of "interpolated spreads" and a reference to a linearly interpolated yield.

**Illiquidity discount** A reduction or discount to value that reflects the lack of depth of trading or liquidity in that asset's market.

**Impairment** Diminishment in value as a result of carrying (book) value exceeding fair value and/or recoverable value.

**Impairment of capital rule** A legal restriction that dividends cannot exceed retained earnings.

**Implementation shortfall** The difference between the money return (or value) on a notional or paper portfolio and the actual portfolio return (or value).

**Implied volatility** The standard deviation that causes an option pricing model to give the current option price.

**In-sample forecast errors** The residuals from a fitted time-series model within the sample period used to fit the model.

**iNAVs** "Indicated" net asset values are intraday "fair value" estimates of an ETF share based on its creation basket.

**Income approach** Valuation approach that values an asset as the present discounted value of the income expected from it. In the context of real estate, this approach estimates the

value of a property based on an expected rate of return; the estimated value is the present value of the expected future income from the property, including proceeds from resale at the end of a typical investment holding period.

**Incremental cash flow** The cash flow that is realized because of a decision; the changes or increments to cash flows resulting from a decision or action.

**Incremental VaR (IVaR)** A measure of the incremental effect of an asset on the VaR of a portfolio by measuring the difference between the portfolio's VaR while including a specified asset and the portfolio's VaR with that asset eliminated.

**Indenture** A written contract between a lender and borrower that specifies the terms of the loan, such as interest rate, interest payment schedule, or maturity.

**Independent board directors** Directors with no material relationship with the company with regard to employment, ownership, or remuneration.

**Independent projects** Independent projects are projects whose cash flows are independent of each other.

**Independent regulators** Regulators recognized and granted authority by a government body or agency. They are not government agencies per se and typically do not rely on government funding.

**Independent variable** A variable used to explain the dependent variable in a regression; a right-hand-side variable in a regression equation.

**Index CDS** A type of credit default swap that involves a combination of borrowers.

**Industrial REITs** REITs that hold portfolios of single-tenant or multi-tenant industrial properties that are used as warehouses, distribution centers, light manufacturing facilities, and small office or "flex" space.

**Industry structure** An industry's underlying economic and technical characteristics.

**Information ratio** (IR) Mean active return divided by active risk; or alpha divided by the standard deviation of diversifiable risk.

**Informational frictions** Forces that restrict availability, quality, and/or flow of information and its use.

**Initial public offering** (IPO) The initial issuance of common stock registered for public trading by a formerly private corporation.

**Inside ask** See *best ask*.

**Inside bid** see *best bid*.

**Inside spread** The spread between the best bid price and the best ask price. Also called the *market bid-ask spread*, *inside bid-ask spread*, or *market spread*.

**Insiders** Corporate managers and board directors who are also shareholders of a company.

**Inter-temporal rate of substitution** The ratio of the marginal utility of consumption  $s$  periods in the future (the numerator) to the marginal utility of consumption today (the denominator).

**Interest rate parity** See *covered interest rate parity*.

**Interest rate risk** Risk that interest rates will change such that the return earned is not commensurate with returns on comparable instruments in the marketplace.

**Interlocking directorates** Corporate structure in which individuals serve on the board of directors of multiple corporations.

**Internal rate of return** (IRR) Rate of return that discounts future cash flows from an investment to the exact amount of the investment; the discount rate that makes the present value of an investment's costs (outflows) equal to the present value of the investment's benefits (inflows).

**International Fisher effect** The proposition that nominal interest rate differentials across currencies are determined by expected inflation differentials.

**Intrinsic value** The value of an asset given a hypothetically complete understanding of the asset's investment characteristics; the value obtained if an option is exercised based on current conditions. The difference between the spot exchange rate and the strike price of a currency.

**Inverse price ratio** The reciprocal of a price multiple, e.g., in the case of a P/E ratio, the "earnings yield" E/P (where P is share price and E is earnings per share).

**Investment value** The value to a specific buyer, taking account of potential synergies based on the investor's requirements and expectations.

**ISDA Master Agreement** A standard or "master" agreement published by the International Swaps and Derivatives Association. The master agreement establishes the terms for each party involved in the transaction.

**Judicial law** Interpretations of courts.

**Justified (fundamental) P/E** The price-to-earnings ratio that is fair, warranted, or justified on the basis of forecasted fundamentals.

**Justified price multiple** The estimated fair value of the price multiple, usually based on forecasted fundamentals or comparables.

**K-fold cross-validation** A technique in which data (excluding test sample and fresh data) are shuffled randomly and then are divided into  $k$  equal sub-samples, with  $k - 1$  samples used as training samples and one sample, the  $k$ th, used as a validation sample.

**K-means** A clustering algorithm that repeatedly partitions observations into a fixed number,  $k$ , of non-overlapping clusters.

**K-nearest neighbor** A supervised learning technique that classifies a new observation by finding similarities ("nearness") between this new observation and the existing data.

**Key rate durations** Sensitivity of a bond's price to changes in specific maturities on the benchmark yield curve. Also called *partial durations*.

**$k$ th order autocorrelation** The correlation between observations in a time series separated by  $k$  periods.

**Labeled data set** A dataset that contains matched sets of observed inputs or features ( $X$ 's) and the associated output or target ( $Y$ ).

**Labor force** Everyone of working age (ages 16 to 64) that either is employed or is available for work but not working.

**Labor force participation rate** The percentage of the working age population that is in the labor force.

**Labor productivity** The quantity of real GDP produced by an hour of labor. More generally, output per unit of labor input.

**Labor productivity growth accounting equation** States that potential GDP growth equals the growth rate of the labor input plus the growth rate of labor productivity.

**Lack of marketability discount** An extra return to investors to compensate for lack of a public market or lack of marketability.

**LASSO** Least absolute shrinkage and selection operator is a type of penalized regression which involves minimizing the sum of the absolute values of the regression coefficients.

**Latency** The elapsed time between the occurrence of an event and a subsequent action that depends on that event.

**Law of one price** A principle that states that if two investments have the same or equivalent future cash flows regardless of what will happen in the future, then these two investments should have the same current price.

**Leading dividend yield** Forecasted dividends per share over the next year divided by current stock price.

**Leading P/E** A P/E calculated on the basis of a forecast of EPS; a stock's current price divided by next year's expected earnings.

**Learning curve** A curve which plots the accuracy rate (= 1 – error rate) in the validation or test samples (i.e., out-of-sample) against the amount of data in the training sample, so is useful for describing under- and overfitting as a function of bias and variance errors.

**Learning rate** A parameter that affects the magnitude of adjustments in the weights in a neural network.

**Level** One of the three factors (the other two are steepness and curvature) that empirically explain most of the changes in the shape of the yield curve. A shock to the level factor changes the yield for all maturities by an almost identical amount.

**Leveraged buyout** (LBO) A transaction whereby the target company management team converts the target to a privately held company by using heavy borrowing to finance the purchase of the target company's outstanding shares.

**Leveraged recapitalization** A post-offer takeover defense mechanism that involves the assumption of a large amount of debt that is then used to finance share repurchases; the effect is to dramatically change the company's capital structure while attempting to deliver a value to target shareholders in excess of a hostile bid.

**Libor-OIS spread** The difference between Libor and the overnight indexed swap (OIS) rate.

**Limit order book** The book or list of limit orders to buy and sell that pertains to a security.

**Linear classifier** A binary classifier that makes its classification decision based on a linear combination of the features of each data point.

**Linear regression** Regression that models the straight-line relationship between the dependent and independent variable(s).

**Linear trend** A trend in which the dependent variable changes at a constant rate with time.

**Liquidating dividend** A dividend that is a return of capital rather than a distribution from earnings or retained earnings.

**Liquidation** To sell the assets of a company, division, or subsidiary piecemeal, typically because of bankruptcy; the form of bankruptcy that allows for the orderly satisfaction of creditors' claims after which the company ceases to exist.

**Liquidation value** The value of a company if the company were dissolved and its assets sold individually.

**Liquidity preference theory** A term structure theory that asserts liquidity premiums exist to compensate investors for the added interest rate risk they face when lending long term.

**Liquidity premium** The premium or incrementally higher yield that investors demand for lending long term.

- Local currency** The currency of the country where a company is located.
- Local expectations theory** A term structure theory that contends the return for all bonds over short time periods is the risk-free rate.
- Locational obsolescence** In the context of real estate, a reduction in value due to decreased desirability of the location of the building.
- Lockout period** Period during which a bond's issuer cannot call the bond.
- Log-linear model** With reference to time-series models, a model in which the growth rate of the time series as a function of time is constant.
- Log-log regression model** A regression that expresses the dependent and independent variables as natural logarithms.
- Logistic regression (logit model)** A qualitative-dependent-variable multiple regression model based on the logistic probability distribution.
- Long/short trade** A long position in one CDS and a short position in another.
- Look-ahead bias** A bias caused by using information that was not available on the test date.
- Lookback period** The time period used to gather a historical data set.
- Loss given default** The amount that will be lost if a default occurs.
- Macroeconomic factor model** A multifactor model in which the factors are surprises in macroeconomic variables that significantly explain equity returns.
- Macroeconomic factors** Factors related to the economy, such as the inflation rate, industrial production, or economic sector membership.
- Maintenance capital expenditures** Capital expenditures needed to maintain operations at the current level.
- Majority shareholders** Shareholders that own more than 50% of a corporation's shares.
- Majority-vote classifier** A classifier that assigns to a new data point the predicted label with the most votes (i.e., occurrences).
- Managerialism theories** Theories that posit that corporate executives are motivated to engage in mergers to maximize the size of their company rather than shareholder value.
- Marginal investor** An investor in a given share who is very likely to be part of the next trade in the share and who is therefore important in setting price.
- Marginal VaR (MVaR)** A measure of the effect on portfolio VaR of a small change in a position size.
- Market approach** Valuation approach that values an asset based on pricing multiples from sales of assets viewed as similar to the subject asset.
- Market conversion premium per share** For a convertible bond, the difference between the market conversion price and the underlying share price, which allows investors to identify the premium or discount payable when buying a convertible bond rather than the underlying common stock.
- Market conversion premium ratio** For a convertible bond, the market conversion premium per share expressed as a percentage of the current market price of the shares.
- Market efficiency** A finance perspective on capital markets that deals with the relationship of price to intrinsic value. The traditional efficient markets formulation asserts that an asset's price is the best available estimate of its intrinsic value. The rational efficient markets formulation asserts that investors should expect to be rewarded for the costs of information gathering and analysis by higher gross returns.
- Market fragmentation** Trading the same instrument in multiple venues.
- Market impact** The effect of the trade on transaction prices. Also called *price impact*.
- Market timing** Asset allocation in which the investment in the market is increased if one forecasts that the market will outperform T-bills.
- Market value** The estimated amount for which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arm's-length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently, and without compulsion.
- Market value of invested capital** The market value of debt and equity.
- Mature growth rate** The earnings growth rate in a company's mature phase; an earnings growth rate that can be sustained long term.
- Maximum drawdown** The worst-returning month or quarter for the portfolio or the worst peak-to-trough decline in a portfolio's returns.
- Mean reversion** The tendency of a time series to fall when its level is above its mean and rise when its level is below its mean; a mean-reverting time series tends to return to its long-term mean.
- Merger** The absorption of one company by another; two companies become one entity and one or both of the pre-merger companies ceases to exist as a separate entity.
- Metadata** Data that describes and gives information about other data.
- Method based on forecasted fundamentals** An approach to using price multiples that relates a price multiple to forecasts of fundamentals through a discounted cash flow model.
- Method of comparables** An approach to valuation that involves using a price multiple to evaluate whether an asset is relatively fairly valued, relatively undervalued, or relatively overvalued when compared to a benchmark value of the multiple.
- Midquote price** The average, or midpoint, of the prevailing bid and ask prices.
- Minority Interest** The proportion of the ownership of a subsidiary not held by the parent (controlling) company.
- Minority shareholders** Shareholders that own less than 50% of a corporation's shares.
- Mispricing** Any departure of the market price of an asset from the asset's estimated intrinsic value.
- Mixed offering** A merger or acquisition that is to be paid for with cash, securities, or some combination of the two.
- Model specification** With reference to regression, the set of variables included in the regression and the regression equation's functional form.
- Molodovsky effect** The observation that P/Es tend to be high on depressed EPS at the bottom of a business cycle, and tend to be low on unusually high EPS at the top of a business cycle.
- Momentum indicators** Valuation indicators that relate either price or a fundamental (such as earnings) to the time series of their own past values (or in some cases to their expected value).

**Monetary assets and liabilities** Assets and liabilities with value equal to the amount of currency contracted for, a fixed amount of currency. Examples are cash, accounts receivable, accounts payable, bonds payable, and mortgages payable. Inventory is not a monetary asset. Most liabilities are monetary.

**Monetary/non-monetary method** Approach to translating foreign currency financial statements for consolidation in which monetary assets and liabilities are translated at the current exchange rate. Non-monetary assets and liabilities are translated at historical exchange rates (the exchange rates that existed when the assets and liabilities were acquired).

**Monetizing** The conversion of the value of a financial transaction into currency.

**Monitoring costs** Costs borne by owners to monitor the management of the company (e.g., board of director expenses).

**Monte Carlo simulation** A method of estimating VaR in which the user develops his or her own assumptions about the statistical characteristics of the distribution and uses those characteristics to generate a distribution that represents hypothetical returns to a portfolio with the specified characteristics.

**Mortgage-backed securities** Asset-backed securitized debt obligations that represent rights to receive cash flows from portfolios of mortgage loans.

**Mortgage REITs** REITs that invest the bulk of their assets in interest-bearing mortgages, mortgage securities, or short-term loans secured by real estate.

**Mortgages** Loans with real estate serving as collateral for the loans.

**Multi-family/residential REITs** REITs that invest in and manage rental apartments for lease to individual tenants, typically using one-year leases.

**Multicollinearity** A regression assumption violation that occurs when two or more independent variables (or combinations of independent variables) are highly but not perfectly correlated with each other.

**Multiple linear regression** Linear regression involving two or more independent variables.

**Multiple linear regression model** A linear regression model with two or more independent variables.

**Mutual information** Measures how much information is contributed by a token to a class of texts. MI will be 0 if the token's distribution in all text classes is the same. MI approaches 1 as the token in any one class tends to occur more often in only that particular class of text.

**Mutually exclusive projects** Mutually exclusive projects compete directly with each other. For example, if Projects A and B are mutually exclusive, you can choose A or B, but you cannot choose both.

**N-grams** A representation of word sequences. The length of a sequence varies from 1 to  $n$ . When one word is used, it is a unigram; a two-word sequence is a bigram; and a 3-word sequence is a trigram; and so on.

**n-Period moving average** The average of the current and immediately prior  $n - 1$  values of a time series.

**Naked credit default swap** A position where the owner of the CDS does not have a position in the underlying credit.

**Name entity recognition** An algorithm that analyzes individual tokens and their surrounding semantics while referring to its dictionary to tag an object class to the token.

**Negative serial correlation** Serial correlation in which a positive error for one observation increases the chance of a negative error for another observation, and vice versa.

**Net asset balance sheet exposure** When assets translated at the current exchange rate are greater in amount than liabilities translated at the current exchange rate. Assets exposed to translation gains or losses exceed the exposed liabilities.

**Net asset value** The difference between assets and liabilities, all taken at current market values instead of accounting book values.

**Net asset value per share** Net asset value divided by the number of shares outstanding.

**Net lease** A lease under which the tenant pays a net rent to the landlord as well as an additional amount based on the tenant's pro rata share of the operating costs, utilities, maintenance expenses, and real estate taxes relating to the property.

**Net liability balance sheet exposure** When liabilities translated at the current exchange rate are greater assets translated at the current exchange rate. Liabilities exposed to translation gains or losses exceed the exposed assets.

**Net operating income** Gross rental revenue minus operating costs, but before deducting depreciation, corporate overhead, and interest expense. In the context of real estate, a measure of the income from the property after deducting operating expenses for such items as property taxes, insurance, maintenance, utilities, repairs, and insurance but before deducting any costs associated with financing and before deducting federal income taxes. It is similar to earnings before interest, taxes, depreciation, and amortization (EBITDA) in a financial reporting context.

**Net operating profit less adjusted taxes (NOPLAT)** A company's operating profit with adjustments to normalize the effects of capital structure.

**Net present value (NPV)** The present value of an investment's cash inflows (benefits) minus the present value of its cash outflows (costs).

**Net regulatory burden** The private costs of regulation less the private benefits of regulation.

**Net rent** A rent that consists of a stipulated rent to the landlord and a further amount based on their share of common area costs for utilities, maintenance, and property taxes.

**Network externalities** The impact that users of a good, a service, or a technology have on other users of that product; it can be positive (e.g., a critical mass of users makes a product more useful) or negative (e.g., congestion makes the product less useful).

**Neural networks** Highly flexible machine learning algorithms that have been successfully applied to a variety of tasks characterized by non-linearities and interactions among features. They typically consist of three layers: input layer; hidden layer, where learning occurs; and output layer.

**New-issue DRP** Dividend reinvestment plan in which the company meets the need for additional shares by issuing them instead of purchasing them.

**No-arbitrage approach** A procedure for obtaining the value of an option based on the creation of a portfolio that replicates the payoffs of the option and deriving the option value from the value of the replicating portfolio.

**No-growth company** A company without positive expected net present value projects.

**No-growth value per share** The value per share of a no-growth company, equal to the expected level amount of earnings divided by the stock's required rate of return.

**Non-cash rent** An amount equal to the difference between the average contractual rent over a lease term (the straight-line rent) and the cash rent actually paid during a period. This figure is one of the deductions made from FFO to calculate AFFO.

**Non-convergence trap** A situation in which a country remains relative poor, or even falls further behind, because it fails to implement necessary institutional reforms and/or adopt leading technologies.

**Non-monetary assets and liabilities** Assets and liabilities that are not monetary assets and liabilities. Non-monetary assets include inventory, fixed assets, and intangibles, and non-monetary liabilities include deferred revenue.

**Non-renewable resources** Finite resources that are depleted once they are consumed; oil and coal are examples.

**Nonconventional cash flow** In a nonconventional cash flow pattern, the initial outflow is not followed by inflows only, but the cash flows can flip from positive (inflows) to negative (outflows) again (or even change signs several times).

**Nonearning assets** Cash and investments (specifically cash, cash equivalents, and short-term investments).

**Nonstationarity** With reference to a random variable, the property of having characteristics such as mean and variance that are not constant through time.

**Normal EPS** The EPS that a business could achieve currently under mid-cyclical conditions. Also called *normalized EPS*.

**Normalized earnings** The expected level of mid-cycle earnings for a company in the absence of any unusual or temporary factors that affect profitability (either positively or negatively).

**Normalized EPS** The EPS that a business could achieve currently under mid-cyclical conditions. Also called *normal EPS*.

**Normalized P/E** P/E based on normalized EPS data.

**Notional amount** The amount of protection being purchased in a CDS.

**NTM P/E** Next twelve months P/E: current market price divided by an estimated next twelve months EPS.

**Off-the-run** A series of securities or indexes that were issued/created prior to the most recently issued/created series.

**Office REITs** REITs that invest in and manage multi-tenanted office properties in central business districts of cities and suburban markets.

**On-the-run** The most recently issued/created series of securities or indexes.

**One hot encoding** The process by which categorical variables are converted into binary form (0 or 1) for machine reading. It is one of the most common methods for handling categorical features in text data.

**One-sided durations** Effective durations when interest rates go up or down, which are better at capturing the interest rate sensitivity of bonds with embedded options that do not react symmetrically to positive and negative changes in interest rates of the same magnitude.

**One-tier board** Board structure consisting of a single board of directors, composed of executive (internal) and non-executive (external) directors.

**Open-market DRP** Dividend reinvestment plan in which the company purchases shares in the open market to acquire the additional shares credited to plan participants.

**Opportunity cost** The value that investors forgo by choosing a particular course of action; the value of something in its best alternative use.

**Optimal capital structure** The capital structure at which the value of the company is maximized.

**Option-adjusted spread** (OAS) Constant spread that, when added to all the one-period forward rates on the interest rate tree, makes the arbitrage-free value of the bond equal to its market price.

**Orderly liquidation value** The estimated gross amount of money that could be realized from the liquidation sale of an asset or assets, given a reasonable amount of time to find a purchaser or purchasers.

**Organic growth** Company growth in output or sales that is achieved by making investments internally (i.e., excludes growth achieved through mergers and acquisitions).

**Other comprehensive income** Changes to equity that bypass (are not reported in) the income statement; the difference between comprehensive income and net income.

**Other post-employment benefits** Promises by the company to pay benefits in the future, such as life insurance premiums and all or part of health care insurance for its retirees.

**Out-of-sample forecast errors** The differences between actual and predicted value of time series outside the sample period used to fit the model.

**Overfitting** When a model fits the training data too well and so does not predict well using new data.

**Pairs trading** An approach to trading that uses pairs of closely related stocks, buying the relatively undervalued stock and selling short the relatively overvalued stock.

**Par curve** A hypothetical yield curve for coupon-paying Treasury securities that assumes all securities are priced at par.

**Par swap** A swap in which the fixed rate is set so that no money is exchanged at contract initiation.

**Parameter instability** The problem or issue of population regression parameters that have changed over time.

**Parametric method** A method of estimating VaR which uses the historical mean, standard deviation, and correlation of security price movements to estimate the portfolio VaR. Generally assumes a normal distribution, but can be adapted to non-normal distributions with the addition of skewness and kurtosis. Sometimes called the *variance-covariance method* or the *analytical method*.

**Partial equilibrium models** Term structure models that make use of an assumed form of interest rate process. Underlying risk factors, such as the impact of changing interest rates on the economy, are not incorporated in the model.

**Partial regression coefficients** The slope coefficients in a multiple regression. Also called *partial slope coefficients*.

**Partial slope coefficients** The slope coefficients in a multiple regression. Also called *partial regression coefficients*.

**Parts of speech** An algorithm that uses language structure and dictionaries to tag every token in the text with a corresponding part of speech (i.e., noun, verb, adjective, proper noun, etc.).

**Payout amount** The payout ratio times the notional.

**Payout policy** The principles by which a company distributes cash to common shareholders by means of cash dividends and/or share repurchases.

**Payout ratio** An estimate of the expected credit loss.

**Payouts** Cash dividends and the value of shares repurchased in any given year.

**Pecking order theory** The theory that managers take into account how their actions might be interpreted by outsiders and thus order their preferences for various forms of corporate financing. Forms of financing that are least visible to outsiders (e.g., internally generated funds) are most preferable to managers and those that are most visible (e.g., equity) are least preferable.

**PEG** The P/E-to-growth ratio, calculated as the stock's P/E divided by the expected earnings growth rate.

**Penalized regression** A regression that includes a constraint such that the regression coefficients are chosen to minimize the sum of squared residuals *plus* a penalty term that increases in size with the number of included features.

**Pension obligation** The present value of future benefits earned by employees for service provided to date.

**Perfect capital markets** Markets in which, by assumption, there are no taxes, transaction costs, or bankruptcy costs and in which all investors have equal ("symmetric") information.

**Perpetuity** A perpetual annuity, or a set of never-ending level sequential cash flows, with the first cash flow occurring one period from now.

**Persistent earnings** Earnings excluding nonrecurring components. Also referred to as *core earnings*, *continuing earnings*, or *underlying earnings*.

**Pet projects** Projects in which influential managers want the corporation to invest. Often, unfortunately, pet projects are selected without undergoing normal capital budgeting analysis.

**Physical deterioration** In the context of real estate, a reduction in value due to wear and tear.

**Physical settlement** Involves actual delivery of the debt instrument in exchange for a payment by the credit protection seller of the notional amount of the contract.

**Poison pill** A pre-offer takeover defense mechanism that makes it prohibitively costly for an acquirer to take control of a target without the prior approval of the target's board of directors.

**Poison puts** A pre-offer takeover defense mechanism that gives target company bondholders the right to sell their bonds back to the target at a pre-specified redemption price, typically at or above par value; this defense increases the need for cash and raises the cost of the acquisition.

**Portfolio balance approach** A theory of exchange rate determination that emphasizes the portfolio investment decisions of global investors and the requirement that global investors willingly hold all outstanding securities denominated in each currency at prevailing prices and exchange rates.

**Positive serial correlation** Serial correlation in which a positive error for one observation increases the chance of a positive error for another observation, and a negative error for one observation increases the chance of a negative error for another observation.

**Potential GDP** The maximum amount of output an economy can sustainably produce without inducing an increase in the inflation rate. The output level that corresponds to full employment with consistent wage and price expectations.

**Precision** In error analysis for classification problems it is ratio of correctly predicted positive classes to all predicted positive classes. Precision is useful in situations where the cost of false positives (FP), or Type I error, is high.

**Preferred habitat theory** A term structure theory that contends that investors have maturity preferences and require yield incentives before they will buy bonds outside of their preferred maturities.

**Premise of value** The status of a company in the sense of whether it is assumed to be a going concern or not.

**Premium leg** The series of payments the credit protection buyer promises to make to the credit protection seller.

**Premiums** Amounts paid by the purchaser of insurance products.

**Present value model** A model of intrinsic value that views the value of an asset as the present value of the asset's expected future cash flows.

**Present value of growth opportunities** The difference between the actual value per share and the no-growth value per share. Also called *value of growth*.

**Presentation currency** The currency in which financial statement amounts are presented.

**Price improvement** When trade execution prices are better than quoted prices.

**Price momentum** A valuation indicator based on past price movement.

**Price multiples** The ratio of a stock's market price to some measure of value per share.

**Price return** Measures the price appreciation or percentage change in price of a security or the securities in an index or portfolio.

**Price-setting option** The operational flexibility to adjust prices when demand varies from forecast. For example, when demand exceeds capacity, the company could benefit from the excess demand by increasing prices.

**Price-to-earnings ratio** (P/E) The ratio of share price to earnings per share.

**Priced risk** Risk for which investors demand compensation for bearing (e.g., equity risk, company-specific factors, macroeconomic factors).

**Principal components analysis** (PCA) A non-parametric method of extracting relevant information from high-dimensional data that uses the dependencies between variables to represent information in a more tractable, lower-dimensional form.

**Principle of no arbitrage** In well-functioning markets, prices will adjust until there are no arbitrage opportunities.

**Prior transaction method** A variation of the market approach; considers actual transactions in the stock of the subject private company.

**Private market value** The value derived using a sum-of-the-parts valuation.

**Probability of default** The probability that a bond issuer will not meet its contractual obligations on schedule.

**Probability of survival** The probability that a bond issuer will meet its contractual obligations on schedule.

**Probit regression (probit model)** A qualitative-dependent-variable multiple regression model based on the normal distribution.

**Procedural law** The body of law that focuses on the protection and enforcement of the substantive laws.

**Production-flexibility** The operational flexibility to alter production when demand varies from forecast. For example, if demand is strong, a company may profit from employees working overtime or from adding additional shifts.

**Project sequencing** To defer the decision to invest in a future project until the outcome of some or all of a current project is known. Projects are sequenced through time, so that investing in a project creates the option to invest in future projects.

**Projection error** The vertical (perpendicular) distance between a data point and a given principal component.

**Prospective P/E** A P/E calculated on the basis of a forecast of EPS; a stock's current price divided by next year's expected earnings.

**Protection leg** The contingent payment that the credit protection seller may have to make to the credit protection buyer.

**Provision for loan losses** An income statement expense account that increases the amount of the allowance for loan losses.

**Proxy fight** An attempt to take control of a company through a shareholder vote.

**Proxy statement** A public document that provides the material facts concerning matters on which shareholders will vote.

**Prudential supervision** Regulation and monitoring of the safety and soundness of financial institutions to promote financial stability, reduce system-wide risks, and protect customers of financial institutions.

**Pruning** A regularization technique used in CART to reduce the size of the classification or regression tree—by using pruning sections of the tree that provide little classifying power are removed.

**Purchasing power gain** A gain in value caused by changes in price levels. Monetary liabilities experience purchasing power gains during periods of inflation.

**Purchasing power loss** A loss in value caused by changes in price levels. Monetary assets experience purchasing power loss during periods of inflation.

**Purchasing power parity (PPP)** The idea that exchange rates move to equalize the purchasing power of different currencies.

**Pure expectations theory** A term structure theory that contends the forward rate is an unbiased predictor of the future spot rate. Also called the *unbiased expectations theory*.

**Pure factor portfolio** A portfolio with sensitivity of 1 to the factor in question and a sensitivity of 0 to all other factors.

**Putable bond** Bond that includes an embedded put option, which gives the bondholder the right to put back the bonds to the issuer prior to maturity, typically when interest rates have risen and higher-yielding bonds are available.

**Qualitative dependent variables** Dummy variables used as dependent variables rather than as independent variables.

**Quality of earnings analysis** The investigation of issues relating to the accuracy of reported accounting results as reflections of economic performance; quality of earnings analysis is broadly understood to include not only earnings management, but also balance sheet management.

**Random forest classifier** A collection of a large number of decision trees trained via a bagging method.

**Random walk** A time series in which the value of the series in one period is the value of the series in the previous period plus an unpredictable random error.

**Rational efficient markets formulation** See *market efficiency*.

**Readme files** Text files provided with raw data that contain information related to a data file. They are useful for understanding the data and how they can be interpreted correctly.

**Real estate investment trusts (REITs)** Tax-advantaged entities (companies or trusts) that typically own, operate, and—to a limited extent—develop income-producing real estate property.

**Real estate operating companies** Regular taxable real estate ownership companies that operate in the real estate industry in countries that do not have a tax-advantaged REIT regime in place or are engaged in real estate activities of a kind and to an extent that do not fit within their country's REIT framework.

**Real interest rate parity** The proposition that real interest rates will converge to the same level across different markets.

**Real options** Options that relate to investment decisions such as the option to time the start of a project, the option to adjust its scale, or the option to abandon a project that has begun.

**Rebalance return** A return from rebalancing the component weights of an index.

**Recall** Also known as *sensitivity*, in error analysis for classification problems it is the ratio of correctly predicted positive classes to all actual positive classes. Recall is useful in situations where the cost of false negatives (FN), or Type II error, is high.

**Reconstitution** When dealers recombine appropriate individual zero-coupon securities and reproduce an underlying coupon Treasury.

**Recovery rate** The percentage of the loss recovered.

**Redemption basket** The list of securities (and share amounts) the authorized participant (AP) receives when it redeems ETF shares back to the ETF manager. The redemption basket is published each business day.

**Reference entity** The borrower on a single-name CDS.

**Reference obligation** A particular debt instrument issued by the borrower that is the designated instrument being covered.

**Regime** With reference to a time series, the underlying model generating the times series.

**Regression coefficients** The intercept and slope coefficient(s) of a regression.

**Regular expression (regex)** A series of texts that contains characters in a particular order. Regex is used to search for patterns of interest in a given text.

**Regularization** A term that describes methods for reducing statistical variability in high dimensional data estimation problems.

**Regulatory arbitrage** Entities identify and use some aspect of regulations that allows them to exploit differences in economic substance and regulatory interpretation or in foreign and domestic regulatory regimes to their (the entities') advantage.

**Regulatory burden** The costs of regulation for the regulated entity.

**Regulatory capture** Theory that regulation often arises to enhance the interests of the regulated.

**Regulatory competition** Regulators may compete to provide a regulatory environment designed to attract certain entities.

**Reinforcement learning** Machine learning in which a computer learns from interacting with itself (or data generated by the same algorithm).

**Relative-strength indicators** Valuation indicators that compare a stock's performance during a period either to its own past performance or to the performance of some group of stocks.

- Relative valuation models** A model that specifies an asset's value relative to the value of another asset.
- Relative VaR** See *ex ante tracking error*.
- Relative version of PPP** The hypothesis that changes in (nominal) exchange rates over time are equal to national inflation rate differentials.
- Renewable resources** Resources that can be replenished, such as a forest.
- Rental price of capital** The cost per unit of time to rent a unit of capital.
- Replacement cost** In the context of real estate, the value of a building assuming it was built today using current construction costs and standards.
- Reporting unit** For financial reporting under US GAAP, an operating segment or one level below an operating segment (referred to as a component).
- Required rate of return** The minimum rate of return required by an investor to invest in an asset, given the asset's riskiness.
- Residential properties** Properties that provide housing for individuals or families. Single-family properties may be owner-occupied or rental properties, whereas multi-family properties are rental properties even if the owner or manager occupies one of the units.
- Residual autocorrelations** The sample autocorrelations of the residuals.
- Residual dividend policy** A policy in which dividends are paid from any internally generated funds remaining after such funds are used to finance positive NPV projects.
- Residual income** Earnings for a given time period, minus a deduction for common shareholders' opportunity cost in generating the earnings. Also called *economic profit* or *abnormal earnings*.
- Residual income method** Income approach that estimates the value of all intangible assets of the business by capitalizing future earnings in excess of the estimated return requirements associated with working capital and fixed assets.
- Residual income model** (RIM) A model of stock valuation that views intrinsic value of stock as the sum of book value per share plus the present value of the stock's expected future residual income per share. Also called *discounted abnormal earnings model* or *Edwards–Bell–Ohlson model*.
- Residual loss** Agency costs that are incurred despite adequate monitoring and bonding of management.
- Restructuring** Reorganizing the financial structure of a firm.
- Retail REITs** REITs that invest in such retail properties as regional shopping malls or community/neighborhood shopping centers.
- Return on capital employed** Operating profit divided by capital employed (debt and equity capital).
- Return on invested capital** A measure of the after-tax profitability of the capital invested by the company's shareholders and debt holders.
- Reverse carry arbitrage** A strategy in involving the short sale of the underlying and an offsetting opposite position in the derivative.
- Reverse stock split** A reduction in the number of shares outstanding with a corresponding increase in share price but no change to the company's underlying fundamentals.
- Reverse stress testing** A risk management approach in which the user identifies key risk exposures in the portfolio and subjects those exposures to extreme market movements.
- Reviewed financial statements** A type of non-audited financial statements; typically provide an opinion letter with representations and assurances by the reviewing accountant that are less than those in audited financial statements.
- Rho** The change in a given derivative instrument for a given small change in the risk-free interest rate, holding everything else constant. Rho measures the sensitivity of the option to the risk-free interest rate.
- Riding the yield curve** A maturity trading strategy that involves buying bonds with a maturity longer than the intended investment horizon. Also called *rolling down the yield curve*.
- Risk budgeting** The allocation of an asset owner's total risk appetite among groups or divisions (in the case of a trading organization) or among strategies and managers (in the case of an institutional or individual investor).
- Risk decomposition** The process of converting a set of holdings in a portfolio into a set of exposures to risk factors.
- Risk factors** Variables or characteristics with which individual asset returns are correlated. Sometimes referred to simply as *factors*.
- Robust standard errors** Standard errors of the estimated parameters of a regression that correct for the presence of heteroskedasticity in the regression's error term.
- Roll** When an investor moves from one series to a new one.
- Roll return** The component of the return on a commodity futures contract attributable to rolling long futures positions forward through time. Also called *roll yield*.
- Rolling down the yield curve** A maturity trading strategy that involves buying bonds with a maturity longer than the intended investment horizon. Also called *riding the yield curve*.
- Root mean squared error (RMSE)** The square root of the average squared forecast error; used to compare the out-of-sample forecasting performance of forecasting models.
- Sales comparison approach** In the context of real estate, this approach estimates value based on what similar or comparable properties (comparables) transacted for in the current market.
- Scaled earnings surprise** Unexpected earnings divided by the standard deviation of analysts' earnings forecasts.
- Scaling** The process of adjusting the range of a feature by shifting and changing the scale of the data. Two of the most common ways of scaling are normalization and standardization.
- Scenario analysis** Analysis that involves changing multiple assumptions at the same time.
- Scree plots** A plot that shows the proportion of total variance in the data explained by each principal component.
- Screening** The application of a set of criteria to reduce a set of potential investments to a smaller set having certain desired characteristics.
- Scrip dividend scheme** Dividend reinvestment plan in which the company meets the need for additional shares by issuing them instead of purchasing them.
- Seasonality** A characteristic of a time series in which the data experiences regular and predictable periodic changes, e.g., fan sales are highest during the summer months.
- Securities offering** A merger or acquisition in which target shareholders are to receive shares of the acquirer's common stock as compensation.
- Security selection risk** See *active specific risk*.

**Segmented markets theory** A term structure theory that contends yields are solely a function of the supply and demand for funds of a particular maturity.

**Self-regulating organizations (SROs)** Self-regulating bodies that are given recognition and authority, including enforcement power, by a government body or agency.

**Self-regulatory bodies** Private, non-governmental organizations that both represent and regulate their members. Some self-regulating organizations are also independent regulators.

**Sell-side analysts** Analysts who work at brokerages.

**Sensitivity analysis** Analysis that shows the range of possible outcomes as specific assumptions are changed; involves changing one assumption at a time.

**Sentence length** The number of characters, including spaces, in a sentence.

**Serially correlated** With reference to regression errors, errors that are correlated across observations.

**Service period** For employee stock options, usually the period between the grant date and the vesting date.

**Settled in arrears** An arrangement in which the interest payment is made at the end of the settlement period.

**Settlement** In the case of a credit event, the process by which the two parties to a CDS contract satisfy their respective obligations.

**Shaping risk** The sensitivity of a bond's price to the changing shape of the yield curve.

**Share repurchase** A transaction in which a company buys back its own shares. Unlike stock dividends and stock splits, share repurchases use corporate cash.

**Shareholder activism** Strategies used by shareholders to attempt to compel a company to act in a desired manner.

**Shareholders' equity** Total assets minus total liabilities.

**Shark repellents** A pre-offer takeover defense mechanism involving the corporate charter (e.g., staggered boards of directors and supermajority provisions).

**Shopping center** REITs that invest in such retail properties as regional shopping malls or community/neighborhood shopping centers.

**Single-name CDS** Credit default swap on one specific borrower.

**Sinking fund bond** A bond which requires the issuer to set aside funds over time to retire the bond issue, thus reducing credit risk.

**Soft margin classification** An adaptation in the support vector machine algorithm which adds a penalty to the objective function for observations in the training set that are misclassified.

**Special dividend** A dividend paid by a company that does not pay dividends on a regular schedule, or a dividend that supplements regular cash dividends with an extra payment.

**Spin-off** A form of restructuring in which shareholders of a parent company receive a proportional number of shares in a new, separate entity; shareholders end up owning stock in two different companies where there used to be one.

**Split-off** A form of restructuring in which shareholders of the parent company are given shares in a newly created entity in exchange for their shares of the parent company.

**Split-rate tax system** In reference to corporate taxes, a split-rate system taxes earnings to be distributed as dividends at a different rate than earnings to be retained. Corporate profits distributed as dividends are taxed at a lower rate than those retained in the business.

**Spot curve** The term structure of spot rates for loans made today.

**Spot price** The current price of an asset or security. For commodities, the current price to deliver a physical commodity to a specific location or purchase and transport it away from a designated location.

**Spot rate** The interest rate that is determined today for a risk-free, single-unit payment at a specified future date.

**Spot yield curve** The term structure of spot rates for loans made today.

**Stabilized NOI** In the context of real estate, the expected NOI when a renovation is complete.

**Stable dividend policy** A policy in which regular dividends are paid that reflect long-run expected earnings. In contrast to a constant dividend payout ratio policy, a stable dividend policy does not reflect short-term volatility in earnings.

**Standard of value** A specification of how "value" is to be understood in the context of a specific valuation.

**Standardized beta** With reference to fundamental factor models, the value of the attribute for an asset minus the average value of the attribute across all stocks, divided by the standard deviation of the attribute across all stocks.

**Standardized unexpected earnings (SUE)** Unexpected earnings per share divided by the standard deviation of unexpected earnings per share over a specified prior time period.

**Static trade-off theory of capital structure** A theory pertaining to a company's optimal capital structure; the optimal level of debt is found at the point where additional debt would cause the costs of financial distress to increase by a greater amount than the benefit of the additional tax shield.

**Statistical factor model** A multifactor model in which statistical methods are applied to a set of historical returns to determine portfolios that best explain either historical return covariances or variances.

**Statutes** Laws enacted by legislative bodies.

**Statutory merger** A merger in which one company ceases to exist as an identifiable entity and all its assets and liabilities become part of a purchasing company.

**Steady state rate of growth** The constant growth rate of output (or output per capita) which can or will be sustained indefinitely once it is reached. Key ratios, such as the capital-output ratio, are constant on the steady-state growth path.

**Steepness** One of the three factors (the other two are level and curvature) that empirically explain most of the changes in the shape of the yield curve. A shock to the steepness factor changes short-term yields more than long-term yields.

**Stock dividend** A type of dividend in which a company distributes additional shares of its common stock to shareholders instead of cash.

**Stock purchase** An acquisition in which the acquirer gives the target company's shareholders some combination of cash and securities in exchange for shares of the target company's stock.

**Stop-loss limit** Constraint used in risk management that requires a reduction in the size of a portfolio, or its complete liquidation, when a loss of a particular size occurs in a specified period.

**Storage REITs** REITs that own and operate self-storage properties, sometimes referred to as mini-warehouse facilities.

**Straight bond** An underlying option-free bond with a specified issuer, issue date, maturity date, principal amount and repayment structure, coupon rate and payment structure, and currency denomination.

**Straight-line rent** The average annual rent under a multi-year lease agreement that contains contractual increases in rent during the life of the lease. For example if the rent is \$100,000 in Year 1, \$105,000 in Year 2, and \$110,000 in Year 3, the average rent to be recognized each year as revenue under straight-line rent accounting is  $(\$100,000 + \$105,000 + \$110,000)/3 = \$105,000$ .

**Straight-line rent adjustment** See *non-cash rent*.

**Straight voting** Voting structure in which shareholders are granted the right of one vote for each share owned.

**Stranded assets** Assets that are obsolete or not economically viable.

**Strategic transaction** A purchase involving a buyer that would benefit from certain synergies associated with owning the target firm.

**Stress tests** A risk management technique which assesses the portfolio's response to extreme market movements.

**Stripping** A dealer's ability to separate a bond's individual cash flows and trade them as zero-coupon securities.

**Subsidiary merger** A merger in which the company being purchased becomes a subsidiary of the purchaser.

**Substantive law** The body of law that focuses on the rights and responsibilities of entities and relationships among entities.

**Succession event** A change of corporate structure of the reference entity, such as through a merger, divestiture, spinoff, or any similar action, in which ultimate responsibility for the debt in question is unclear.

**Sum-of-the-parts valuation** A valuation that sums the estimated values of each of a company's businesses as if each business were an independent going concern.

**Summation operator** A functional part of a neural network's node that multiplies each input value received by a weight and sums the weighted values to form the total net input, which is then passed to the activation function.

**Sunk cost** A cost that has already been incurred.

**Supernormal growth** Above average or abnormally high growth rate in earnings per share.

**Supervised learning** Machine learning where algorithms infer patterns between a set of inputs (the  $X$ 's) and the desired output ( $Y$ ). The inferred pattern is then used to map a given input set into a predicted output.

**Support vector machine** A linear classifier that determines the hyperplane that optimally separates the observations into two sets of data points.

**Survivorship bias** Bias that may result when failed or defunct companies are excluded from membership in a group.

**Sustainable growth rate** The rate of dividend (and earnings) growth that can be sustained over time for a given level of return on equity, keeping the capital structure constant and without issuing additional common stock.

**Swap curve** The term structure of swap rates.

**Swap rate** The interest rate for the fixed-rate leg of an interest rate swap.

**Swap rate curve** The term structure of swap rates.

**Swap spread** The difference between the fixed rate on an interest rate swap and the rate on a Treasury note with equivalent maturity; it reflects the general level of credit risk in the market.

**Synthetic CDO** Created by combining a portfolio of default-free securities with a combination of credit default swaps undertaken as protection sellers.

**Systematic risk** Risk that affects the entire market or economy; it cannot be avoided and is inherent in the overall market. Systematic risk is also known as non-diversifiable or market risk.

**Systemic risk** The risk of failure of the financial system.

**Tail risk** The risk that losses in extreme events could be greater than would be expected for a portfolio of assets with a normal distribution.

**Takeover** A merger; the term may be applied to any transaction, but is often used in reference to hostile transactions.

**Takeover premium** The amount by which the takeover price for each share of stock must exceed the current stock price in order to entice shareholders to relinquish control of the company to an acquirer.

**Tangible book value per share** Common shareholders' equity minus intangible assets reported on the balance sheet, divided by the number of shares outstanding.

**Target** In machine learning, the dependent variable ( $Y$ ) in a labeled dataset; the company in a merger or acquisition that is being acquired.

**Target capital structure** A company's chosen proportions of debt and equity.

**Target company** The company in a merger or acquisition that is being acquired.

**Target payout ratio** A strategic corporate goal representing the long-term proportion of earnings that the company intends to distribute to shareholders as dividends.

**Technical indicators** Momentum indicators based on price.

**TED spread** A measure of perceived credit risk determined as the difference between Libor and the T-bill yield of matching maturity.

**Temporal method** A variation of the monetary/non-monetary translation method that requires not only monetary assets and liabilities, but also non-monetary assets and liabilities that are measured at their current value on the balance sheet date to be translated at the current exchange rate. Assets and liabilities are translated at rates consistent with the timing of their measurement value. This method is typically used when the functional currency is other than the local currency.

**Tender offer** A public offer whereby the acquirer invites target shareholders to submit ("tender") their shares in return for the proposed payment.

**Term frequency (TF)** Ratio of the number of times a given token occurs in all the texts in the dataset to the total number of tokens in the dataset.

**Term premium** The additional return required by lenders to invest in a bond to maturity net of the expected return from continually reinvesting at the short-term rate over that same time horizon.

**Terminal price multiples** The price multiple for a stock assumed to hold at a stated future time.

**Terminal share price** The share price at a particular point in the future.

**Terminal value of the stock** The analyst's estimate of a stock's value at a particular point in the future. Also called *continuing value of the stock*.

**Termination date** The date of the final payment on a swap; also, the swap's expiration date.

**Test sample** A data sample that is used to test a model's ability to predict well on new data.

**Theta** The change in a derivative instrument for a given small change in calendar time, holding everything else constant. Specifically, the theta calculation assumes nothing changes except calendar time. Theta also reflects the rate at which an option's time value decays.

**Time series** A set of observations on a variable's outcomes in different time periods.

**Tobin's  $q$**  The ratio of the market value of debt and equity to the replacement cost of total assets.

**Token** The equivalent of a word (or sometimes a character).

**Tokenization** The process of splitting a given text into separate tokens. Tokenization can be performed at the word or character level but is most commonly performed at word level.

**Top-down approach** With respect to forecasting, an approach that usually begins at the level of the overall economy. Forecasts are then made at more narrowly defined levels, such as sector, industry, and market for a specific product.

**Top-down investing** An approach to investing that typically begins with macroeconomic forecasts.

**Total factor productivity (TFP)** A multiplicative scale factor that reflects the general level of productivity or technology in the economy. Changes in total factor productivity generate proportional changes in output for any input combination.

**Total invested capital** The sum of market value of common equity, book value of preferred equity, and face value of debt.

**Tracking error** The standard deviation of the differences between a portfolio's returns and its benchmark's returns; a synonym of active risk. Also called *tracking risk*.

**Tracking risk** The standard deviation of the differences between a portfolio's returns and its benchmark's returns; a synonym of active risk. Also called *tracking error*.

**Trailing dividend yield** The reciprocal of current market price divided by the most recent annualized dividend.

**Trailing P/E** A stock's current market price divided by the most recent four quarters of EPS (or the most recent two semi-annual periods for companies that report interim data semi-annually.) Also called *current P/E*.

**Training sample** A data sample that is used to train a model.

**Tranche CDS** A type of credit default swap that covers a combination of borrowers but only up to pre-specified levels of losses.

**Transaction exposure** The risk of a change in value between the transaction date and the settlement date of an asset of liability denominated in a foreign currency.

**Treasury shares** Shares that were issued and subsequently repurchased by the company.

**Treasury stock** Shares that were issued and subsequently repurchased by the company.

**Trend** A long-term pattern of movement in a particular direction.

**Triangular arbitrage** An arbitrage transaction involving three currencies that attempts to exploit inconsistencies among pairwise exchange rates.

**Trimming** Also called truncation, it is the process of removing extreme values and outliers from a dataset.

**Two-tier board** Board structure consisting of a supervisory board that oversees a management board.

**Unbiased expectations theory** A term structure theory that contends the forward rate is an unbiased predictor of the future spot rate. Also called the *pure expectations theory*.

**Unconditional heteroskedasticity** Heteroskedasticity of the error term that is not correlated with the values of the independent variable(s) in the regression.

**Uncovered interest rate parity** The proposition that the expected return on an uncovered (i.e., unhedged) foreign currency (risk-free) investment should equal the return on a comparable domestic currency investment.

**Underlying earnings** Earnings excluding nonrecurring components. Also referred to as *continuing earnings*, *core earnings*, or *persistent earnings*.

**Unexpected earnings** The difference between reported EPS and expected EPS. Also referred to as an *earnings surprise*.

**Unit root** A time series that is not covariance stationary is said to have a unit root.

**Unlimited funds** An unlimited funds environment assumes that the company can raise the funds it wants for all profitable projects simply by paying the required rate of return.

**Unsupervised learning** Machine learning that does not make use of labeled data.

**Upfront payment** The difference between the credit spread and the standard rate paid by the protection if the standard rate is insufficient to compensate the protection seller. Also called *upfront premium*.

**Upfront premium** See *upfront payment*.

**UPREITs** An umbrella partnership REIT under which the REIT owns an operating partnership and serves as the general partner of the operating partnership. All or most of the properties are held in the operating partnership.

**Upstream** A transaction between two related companies, an investor company (or a parent company) and an associate company (or a subsidiary company) such that the associate company records a profit on its income statement. An example is a sale of inventory by the associate to the investor company or by a subsidiary to a parent company.

**Validation sample** A data sample that is used to validate and tune a model.

**Valuation** The process of determining the value of an asset or service on the basis of variables perceived to be related to future investment returns, or on the basis of comparisons with closely similar assets.

**Value additivity** An arbitrage opportunity when the value of the whole equals the sum of the values of the parts.

**Value at risk (VaR)** The minimum loss that would be expected a certain percentage of the time over a certain period of time given the assumed market conditions.

**Value of growth** The difference between the actual value per share and the no-growth value per share.

**Variance error** Describes how much a model's results change in response to new data from validation and test samples. Unstable models pick up noise and produce high variance error, causing overfitting and high out-of-sample error.

**Vasicek model** A partial equilibrium term structure model that assumes interest rates are mean reverting and interest rate volatility is a constant.

**Vega** The change in a given derivative instrument for a given small change in volatility, holding everything else constant. A sensitivity measure for options that reflects the effect of volatility.

**Venture capital investors** Private equity investors in development-stage companies.

**Vertical merger** A merger involving companies at different positions of the same production chain; for example, a supplier or a distributor.

**Vertical ownership** Ownership structure in which a company or group that has a controlling interest in two or more holding companies, which in turn have controlling interests in various operating companies.

**Vested benefit obligation** The actuarial present value of vested benefits.

**Vesting date** The date that employees can first exercise stock options.

**Visibility** The extent to which a company's operations are predictable with substantial confidence.

**Voting caps** Legal restrictions on the voting rights of large share positions.

**Web spidering (scraping or crawling) programs** Programs that extract raw content from a source, typically web pages.

**Weighted average cost of capital** (WACC) A weighted average of the after-tax required rates of return on a company's common stock, preferred stock, and long-term debt, where the weights are the fraction of each source of financing in the company's target capital structure.

**Weighted harmonic mean** See *harmonic mean*.

**White-corrected standard errors** A synonym for robust standard errors.

**White knight** A third party that is sought out by the target company's board to purchase the target in lieu of a hostile bidder.

**White squire** A third party that is sought out by the target company's board to purchase a substantial minority stake in the target—enough to block a hostile takeover without selling the entire company.

**Winner's curse** The tendency for the winner in certain competitive bidding situations to overpay, whether because of overestimation of intrinsic value, emotion, or information asymmetries.

**Winsorization** The process of replacing extreme values and outliers in a dataset with the maximum (for large value outliers) and minimum (for small value outliers) values of data points that are not outliers.

**Write-down** A reduction in the value of an asset as stated in the balance sheet.

**Yield curve factor model** A model or a description of yield curve movements that can be considered realistic when compared with historical data.

**Z-spread** The constant basis point spread that needs to be added to the implied spot yield curve such that the discounted cash flows of a bond are equal to its current market price.

**Zero** A bond that does not pay a coupon but is priced at a discount and pays its full face value at maturity.

**Zero-coupon bond** A bond that does not pay a coupon but is priced at a discount and pays its full face value at maturity.