



BEHAVIORAL FINANCE AND CAPITAL MARKET EXPECTATIONS

CFA® Program Curriculum
2020 • LEVEL III • VOLUME 2

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How to Use the CFA Program Curriculum

Congratulations on reaching Level III 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.

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, who 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 applications of that knowledge. For more information on the practice analysis, CBOK, and development of the CFA Program curriculum, please visit www.cfainstitute.org.

ORGANIZATION OF THE CURRICULUM

The Level III CFA Program curriculum is organized into seven 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—16 sessions in the Level III 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 16 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), including the descriptions of LOS “command words” on the candidate resources page at www.cfainstitute.org.

FEATURES OF THE CURRICULUM

**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 using your candidate credentials.

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.

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 III curriculum includes 16 study sessions, a good plan is to devote 15–20 hours per week for 16 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.

As you prepare for your exam, 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 question sets, please visit 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.

Preparatory Providers After you enroll in the CFA Program, you may receive numerous solicitations for preparatory courses and review materials. When considering a prep 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.

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.
- 4 Create a schedule and commit sufficient study time to cover the 16 study sessions, using the study planner. You should also plan to review the materials and take practice questions 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.

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. 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.

Portfolio Management

STUDY SESSIONS

Study Session 3	Behavioral Finance
Study Session 4	Capital Market Expectations
Study Session 5	Asset Allocation and Related Decisions in Portfolio Management
Study Session 6	Derivatives and Currency Management
Study Session 7	Fixed-Income Portfolio Management (1)
Study Session 8	Fixed-Income Portfolio Management (2)
Study Session 9	Equity Portfolio Management (1)
Study Session 10	Equity Portfolio Management (2)
Study Session 11	Alternative Investments Portfolio Management
Study Session 12	Private Wealth Management (1)
Study Session 13	Private Wealth Management (2)
Study Session 14	Portfolio Management for Institutional Investors
Study Session 15	Trading, Performance Evaluation, and Manager Selection
Study Session 16	Cases in Portfolio Management and Risk Management

This volume includes Study Sessions 3–4.

TOPIC LEVEL LEARNING OUTCOME

The candidate should be able to prepare an appropriate investment policy statement and asset allocation; formulate strategies for managing, monitoring, and rebalancing investment portfolios; and evaluate portfolio performance.

PORTFOLIO MANAGEMENT STUDY SESSION

3

Behavioral Finance

Behavioral finance is introduced in the first study session on portfolio management because all market participants, regardless of expertise or experience, may be subject to behavioral biases. Behavioral finance provides insight into how emotional biases and cognitive errors may influence individuals' perceptions and investment decisions. As a consequence, knowledge of behavioral biases may help in understanding client goals, in constructing investment portfolios, and in identifying inconsistencies in investment decision making. Behavioral finance also provides insights into issues such as market anomalies. The readings propose that integration of behavioral and traditional finance may lead to a better outcome than either approach used in isolation.

READING ASSIGNMENTS

Reading 7	The Behavioral Finance Perspective by Michael M. Pompian, CFA
Reading 8	The Behavioral Biases of Individuals by Michael M. Pompian, CFA
Reading 9	Behavioral Finance and Investment Processes by Michael M. Pompian, CFA, Colin McLean, MBA, FIA, FSIP, and Alistair Byrne, PhD, CFA

Note: The readings in this study session use widely recognized terminology. Nevertheless, readers should be aware that writers on behavioral finance vary in their choice of terminology.

READING

7

The Behavioral Finance Perspective

by Michael M. Pompian, CFA

Michael M. Pompian, CFA, is at Sunpointe Investments (USA)

LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. contrast traditional and behavioral finance perspectives on investor decision making;
<input type="checkbox"/>	b. contrast expected utility and prospect theories of investment decision making;
<input type="checkbox"/>	c. discuss the effect that cognitive limitations and bounded rationality may have on investment decision making;
<input type="checkbox"/>	d. compare traditional and behavioral finance perspectives on portfolio construction and the behavior of capital markets.

INTRODUCTION

1

Behavioral finance attempts to understand and explain observed investor and market behaviors. This differs from traditional (standard) finance, which is based on hypotheses about how investors and markets should behave. In other words, behavioral finance differs from traditional finance in that it focuses on how investors and markets behave in practice rather than in theory. By focusing on actual behavior, behavioral researchers have observed that individuals make investment decisions in ways and with outcomes that differ from the approaches and outcomes of traditional finance. As Meir Statman so succinctly puts it, “Standard finance people are modeled as “rational,” whereas behavioral finance people are modeled as “normal.”¹ Normal people behave in a manner and with outcomes that may appear irrational or suboptimal from a traditional finance perspective. As a result of identified divergence between observed and theoretically optimal decision making, the global investment community has begun to realize that it cannot rely entirely on scientific, mathematical, or economic models to explain individual investor and market behavior.

¹ Statman (1999).

As behavioral finance gains acceptance, efforts to understand what drives individual investor and market behavior will increase. Complete understanding will never be possible, however, because human behavior cannot be predicted with scientific precision or fully explained by a simple “unifying theory.” In fact, trying to predict economic behavior, and by extension market behavior, has been likened to trying to predict the weather.

Like weather forecasters, economic forecasters must deal with a system that is extraordinarily complex, that is subject to random shocks, and about which our data and understanding will always be imperfect. In some ways, predicting the economy is even more difficult than forecasting the weather, because the economy is not made up of molecules whose behavior is subject to the laws of physics, but rather of human beings who are themselves thinking about the future and whose behavior may be influenced by the forecasts that they or others make. To be sure, historical relationships and regularities can help economists, as well as weather forecasters, gain some insight into the future, but these must be used with considerable caution and healthy skepticism.

US Federal Reserve Chairman Ben Bernanke²

At its core, behavioral finance is about understanding how people make decisions, both individually and collectively. By understanding how investors and markets behave, it may be possible to modify or adapt to their behaviors in order to improve economic outcomes. In many instances, this may entail identifying a behavior and then modifying the behavior so it more closely matches that assumed under the traditional finance models. In other instances, it may be necessary to adapt to an identified behavior and to make decisions that adjust for the behavior. The integration of behavioral and traditional finance has the potential to produce a superior economic outcome; the resulting financial decision may produce an economic outcome closer to the optimal outcome of traditional finance, while being easier for an investor to adhere to in practice.

To provide a framework for understanding the implications of the decision-making process for financial market practitioners, throughout this reading we will use an approach developed by decision theorist, Howard Raiffa. Raiffa (1997) discusses three approaches to the analysis of decisions that provide a more accurate view of a “real” person’s thought process. He uses the terms normative analysis, descriptive analysis, and prescriptive analysis. Normative analysis is concerned with the rational solution to the problem at hand. It defines an ideal that actual decisions should strive to approximate. Descriptive analysis is concerned with the manner in which real people actually make decisions. Prescriptive analysis is concerned with practical advice and tools that might help people achieve results more closely approximating those of normative analysis. We can think of the traditional finance assumptions about behavior as normative, behavioral finance explanations of behaviors as descriptive, and efforts to use behavioral finance in practice as prescriptive.

In order to use behavioral finance in practice, it is important to understand how behavioral finance differs from traditional finance and some of the theoretical perspectives that are relevant to the understanding of the differences. Section 2 compares and contrasts behavioral and traditional perspectives of investor behaviors. Section 3 discusses theories that relax the assumptions about investor behavior that are inherent

² Bernanke (2009).

in traditional finance. Section 4 compares and contrasts traditional and behavioral finance perspectives of market behaviors and portfolio construction. A summary and practice problems conclude the reading.

BEHAVIORAL VERSUS TRADITIONAL PERSPECTIVES

2

Traditional finance is grounded in neoclassical economics. Within traditional finance, individuals are assumed to be risk-averse, self-interested utility maximizers. Investors who behave in a manner consistent with these assumptions are referred to as rational. Traditional finance further hypothesizes that, at the market level, prices incorporate and reflect all available and relevant information. Markets that behave in a manner consistent with this hypothesis are described as efficient.

Behavioral finance is largely grounded in psychology. The term behavioral finance—generally defined as the application of psychology to finance—appears regularly in books, magazine articles, and investment papers; however, a common understanding of what is meant by behavioral finance is lacking. This may be because of a proliferation of topics resembling behavioral finance that examine investor behavior: These include behavioral economics, investor psychology, behavioral science, experimental economics, and cognitive psychology. Such emerging subjects as neuro-economics and adaptive finance (also known as evolutionary finance) are making their way into the conversation and provide another perspective on investor behavior. The variety of approaches taken to examine investor behavior adds to the confusion about what is meant by behavioral finance.

Behavioral finance attempts to understand and explain observed investor and market behaviors and bases its assumptions on observed financial behavior rather than on idealized financial behavior. Behavioral finance neither assumes that people act rationally and consider all available information in decision making nor that markets are efficient. To make behavioral finance easier to understand—and to differentiate the study of individual investor behavior from collective market behavior—behavioral finance in this reading is classified as either behavioral finance micro (BFMI) or behavioral finance macro (BFMA). Behavioral finance micro examines behaviors or biases that distinguish individual investors from the rational actors envisioned in neoclassical economic theory. Behavioral finance macro considers market anomalies that distinguish markets from the efficient markets of traditional finance. Whether BFMI or BFMA is of greater interest to practitioners depends on many factors, including the job held. For example, the primary focus of wealth managers and investment advisers to individual clients is BFMI (i.e., the behavior of individuals), while the primary focus of fund managers and economists is BFMA (i.e., the behavior of markets).

Regardless of whether BFMI or BFMA is of primary interest, it is critical to understand that much of traditional financial theory is based on the assumptions that individuals act rationally and consider all available information in the decision-making process and that markets are efficient. Behavioral finance challenges these assumptions. BFMI questions the perfect rationality and decision-making process of individual investors, and BFMA questions the efficiency of markets.

BFMI suggests that behavioral biases impact the financial decisions of individual investors. Behavioral biases can be categorized as cognitive errors or emotional biases. Cognitive errors stem from basic statistical, information-processing, or memory errors; cognitive errors may be considered to result from reasoning based on faulty thinking. Emotional biases stem from impulse or intuition; emotional biases may be considered to result from reasoning influenced by feelings. Behavioral biases, cognitive

or emotional, may cause decisions to deviate from the rational decisions of traditional finance. BFMA suggests that markets are subject to behavioral effects. These behavioral effects may cause markets to deviate from the efficient markets of traditional finance.

Meir Statman, a prolific contributor to behavioral finance research, states comprehensively, “Standard finance is the body of knowledge built on the pillars of the arbitrage principles of Miller and Modigliani, the portfolio principles of Markowitz, the capital asset pricing theory of Sharpe, Lintner, and Black, and the option pricing theory of Black, Scholes, and Merton.”³ Statman’s point is that traditional (standard) finance theory is designed to provide mathematically elegant explanations for financial questions that, when posed in real life, are often complicated by imprecise conditions. The traditional finance approach relies on assumptions that tend to oversimplify reality and are challenged by behavioral finance.

Sections 2.1, 2.2, and 2.3 focus on assumptions about investor behavior (BFMI). Section 2.1 provides an overview of the traditional finance perspective of individual behavior; section 2.2 discusses the behavioral finance challenges to the traditional finance perspective of individual behavior; and section 2.3 briefly introduces neuroeconomics and its potential role in explaining individual investor behavior. Following section 2 and its discussions of traditional finance and behavioral finance perspectives, section 3 primarily addresses theories developed in response to apparent deviations from the assumptions of traditional finance regarding decision making.

2.1 Traditional Finance Perspectives on Individual Behavior

Traditional finance concepts may be thought of as normative, indicating how people and markets should behave. Investors are assumed to be rational; investors make decisions consistent with utility theory and revise expectations (update beliefs) consistent with Bayes’ formula. They are further assumed to be self-interested and risk-averse, to have access to perfect information, and to process all available information in an unbiased way. Each of these underlying assumptions will be discussed further in the following subsections.

2.1.1 Utility Theory and Bayes’ Formula

In **utility theory**, people maximize the present value of utility subject to a present value budget constraint.⁴ **Utility** may be thought of as the level of relative satisfaction received from the consumption of goods and services. Decision makers choose between risky or uncertain prospects by comparing their expected utility values. They maximize their expected utility—the weighted sum of the utility values of outcomes multiplied by their respective probabilities—subject to their budget constraints. It is important to note that the determination of the value of an item is not based on its price, but rather on the utility it yields. The price of an item is dependent only on the characteristics of the item and is equal for everyone; the utility, however, is dependent on the particular circumstances and preferences of the person making the estimate of utility.

For our purposes, it is not important to understand fully the mathematical aspects of the expected utility model, which assumes that it is possible to quantify exactly how much utility an individual will derive based on the uncertain outcome of an economic decision and that the individual can and will choose between various options to arrive at an optimal decision that maximizes the individual’s expected utility. Normatively, this is how people *should* make economic decisions; it is important to understand expected utility theory conceptually.

³ Statman (1999).

⁴ See, for example, Samuelson (1937).

There are some basic axioms of utility theory.⁵ It is assumed that a rational decision maker follows rules of preference consistent with the axioms and that the utility function of a rational decision maker reflects the axioms. From any set of alternatives, a *rational* decision maker makes decisions consistent with the axioms of utility theory and chooses the combination of decisions that maximizes expected utility. The basic axioms of utility theory are completeness, transitivity, independence, and continuity.

- *Completeness* assumes that an individual has well-defined preferences and can decide between any two alternatives.

Axiom (Completeness): Given choices A and B, the individual either prefers A to B, prefers B to A, or is indifferent between A and B.

- *Transitivity* assumes that, as an individual decides according to the completeness axiom, an individual decides consistently.

Axiom (Transitivity): Transitivity is illustrated by the following examples. Given choices A, B, and C, if an individual prefers A to B and prefers B to C, then the individual prefers A to C; if an individual prefers A to B and is indifferent between B and C, then the individual prefers A to C; or, if an individual is indifferent between A and B and prefers A to C, then the individual prefers B to C.

- *Independence* also pertains to well-defined preferences and assumes that the preference order of two choices combined in the same proportion with a third choice maintains the same preference order as the original preference order of the two choices.

Axiom (Independence): Let A and B be two mutually exclusive choices, and let C be a third choice that can be combined with A or B. If A is preferred to B and some amount, x , of C is added to A and B, then A plus x C is preferred to B plus x C. This assumption allows for additive utilities. If the utility of A is dependent on how much of C is available, the utilities are not additive.

- *Continuity* assumes there are continuous (unbroken) indifference curves such that an individual is indifferent between all points, representing combinations of choices, on a single indifference curve.

Axiom (Continuity): When there are three lotteries (A, B, and C) and the individual prefers A to B and B to C, then there should be a possible combination of A and C such that the individual is indifferent between this combination and the lottery B. The end result is continuous indifference curves.

If the individual's decision making satisfies the four axioms, the individual is said to be rational. Put another way, if an individual is to maximize utility, he or she will choose one alternative over another if and only if the expected utility of one alternative exceeds the expected utility of the other alternative. The utility of any choice may be expressed as a function of the utility of the possible outcomes of the choice and their respective probabilities. If an individual believes a choice has possible outcomes, x_i , each with a utility of $u(x_i)$ and a subjective probability of $P(x_i)$, then the individual's subjective expected utility is $\sum u(x_i)P(x_i)$.⁶ The completely rational individual makes decisions based on the axioms of utility theory in order to maximize expected utility.

The rational decision maker, given new information, is assumed to update beliefs about probabilities according to Bayes' formula. **Bayes' formula** is a mathematical rule explaining how existing probability beliefs should be changed given new information. In other words, Bayes' formula expects people to update old beliefs in a certain manner when given new information. Bayes' formula is essentially an application of conditional

⁵ See von Neumann and Morgenstern (1944).

⁶ See Savage (1954).

probabilities. This formula is valid in all common probability interpretations. In order to develop the calculation, all possible events must be mutually exclusive and exhaustive events with known probabilities.

Bayes' formula shows how one conditional probability is inversely related to the probability of another mutually exclusive outcome. The formula is:

$$P(A|B) = [P(B|A)/P(B)] P(A)$$

where:

$P(A|B)$ = conditional probability of event A given B. It is the updated probability of A given the new information B.

$P(B|A)$ = conditional probability of B given A. It is the probability of the new information B given event A.

$P(B)$ = prior (unconditional) probability of information B.

$P(A)$ = prior probability of event A, without new information B. This is the base rate or base probability of event A.

EXAMPLE 1

Example of Bayes' Formula

You have two identical urns, U1 and U2. U1 has 2 red balls (R) and 3 white balls (W). U2 has 4 red balls and 1 white ball. You randomly choose one of the urns to pick out a ball. A red ball is pulled out first. What is the probability that you picked U1, based on the fact that a red ball was pulled out first, $P(U1|R)$?

Solution:

$P(R|U1)$ is the conditional probability of a red ball being pulled out, given U1 is picked:

$$2 \text{ red balls}/5 \text{ balls} = 40\%$$

$P(U1)$ is the probability of picking U1:

$$1 \text{ urn}/2 \text{ urns} = 50\%$$

$P(R)$ is the probability of a red ball being picked regardless of which urn is picked:

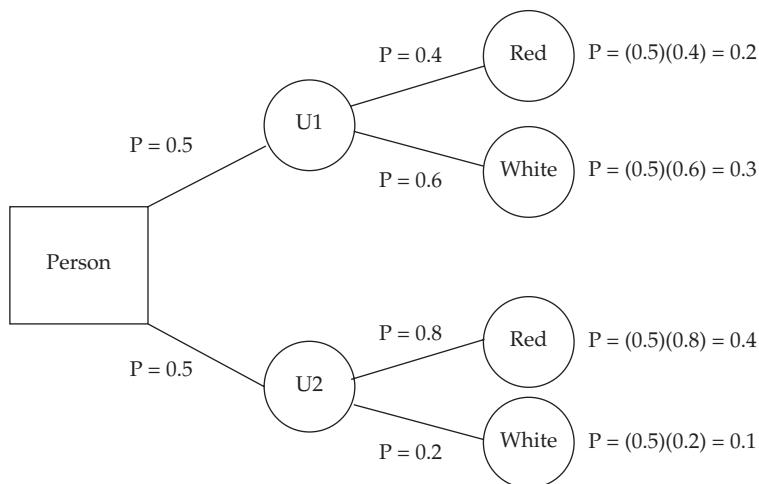
$$2 \text{ red balls in } U1 + 4 \text{ red balls in } U2 = 6 \text{ red balls}$$

$$6 \text{ red balls}/10 \text{ balls} = 60\%$$

$P(U1|R)$ is the objective of the exercise. Based on the above formula, we calculate:

$$P(U1|R) = [P(R|U1)/P(R)] P(U1) = [40%/60%]50\% = 33.3\%$$

This solution can also be shown using a probability tree. In Exhibit 1, we can see that the probability of U1 being picked and a red ball being chosen is $P(U1) \times P(R|U1) = (0.5 \times 0.4) = 0.20$. The probability of picking a red ball if either urn is picked is $P(R) = (0.20 + 0.40) = 0.60$. Therefore, because we know that a red ball was picked, we can find the probability of having chosen U1 by dividing the probability of choosing both U1 and a red ball by the probability of choosing a red ball. This gives us 0.333 or 33.3% [= 0.20/0.60].

Exhibit 1 Probability Tree

Different people may make different decisions because they may have different utility functions or different beliefs about the probabilities of different outcomes.

In a perfect world, when people make decisions under uncertainty, they are assumed to do the following:

- 1 Adhere to the axioms of utility theory.
- 2 Behave in such a way as to assign a probability measure to possible events.
- 3 Incorporate new information by conditioning probability measures according to Bayes' formula.
- 4 Choose an action that maximizes the utility function subject to budget constraints (consistently across different decision problems) with respect to this conditional probability measure.

Is it reasonable, however, to think that ordinary people perform Bayesian updating on a consistent basis or make decisions as if they perform Bayesian updating? Bayesian updating requires the ability to perform complicated statistical calculations. People have cognitive limitations not accounted for in expected utility theory. Behavioral finance proponents argue that it seems highly unlikely that people actually take each of these steps as a matter of procedure every time they make a decision or that the decisions of people are consistent with those that would be made on the basis of Bayesian updating.

2.1.2 Rational Economic Man

Traditional finance assumes that after gathering information and analyzing it according to Bayes' formula, individuals will make decisions consistent with the decisions of homo economicus or **rational economic man** (REM). REM will try to obtain the highest possible economic well-being or utility given budget constraints and the available information about opportunities, and he will base his choices only on the consideration of his own personal utility, not considering the well-being of others except to the extent this impacts REM's utility. Using indifference curve analysis, rational economic man will determine the choices that will combine to give him the highest utility. REM will construct curves of consumption bundles amongst which

he is indifferent because each bundle gives the same utility. The curve that is within budget constraints and furthest from the origin gives the highest utility. Choices made by REM will fall on that curve.

The notion of rational economic man was developed in the late 19th century as a simple model of human economic behavior. The model assumes that humans make perfectly rational economic decisions at all times. REM is a rational, self-interested, labor-averse individual who has the ability to make judgments about his subjectively defined ends. REM also strives to maximize economic well-being by selecting strategies contingent on predetermined, utility-optimizing goals on the information that he possesses as well as on any other postulated constraints. REM tries to achieve discretely specified goals to the most comprehensive, consistent extent possible while minimizing economic costs.

The amount of utility that REM associates with any given outcome is represented by the output of his algebraic utility function. Predicting how REM will negotiate complex trade-offs, such as the pursuit of wages versus leisure, entails the use of mathematical models using calculus. REM ignores social values unless adhering to them will give him pleasure (i.e., provide utility) or failing to adhere to them will cause him pain (i.e., create disutility). Principles of perfect rationality, perfect self-interest, and perfect information govern REM's economic decisions.

2.1.3 Perfect Rationality, Self-Interest, and Information

REM is assumed to maximize utility and make complex deductions toward that end. He is capable of thinking through all possible outcomes and choosing the course of action that will result in the best possible outcome. Perfect rationality assumes that REM is a perfectly rational thinker and has the ability to reason and make beneficial judgments at all times. In reality, however, rationality is not the sole driver of human behavior. At times, it is observed that the human intellect is subservient to such human emotions as fear, love, hate, pleasure, and pain. Moreover, people often use their intellects to achieve or avoid these emotional outcomes.

Perfect self-interest is the idea that humans are perfectly selfish. For every economic decision, REM ensures that he is getting the highest possible utility and will never concede anything to his opponent in a transaction. Many studies have shown that people are not perfectly self-interested. If they were, philanthropy would not exist. Religions prizes selflessness, sacrifice, and kindness to strangers would also be unlikely to thrive as they have over millennia. Perfect self-interest would preclude people from performing unselfish deeds, such as volunteering, helping the needy, or serving in the military. If behaving in an apparently altruistic manner generates utility for the giver, however, then such behavior is consistent with self-interest and may be viewed as rational.

Some people may possess perfect or near-perfect information on certain subjects. A doctor or dentist, for example, should be impeccably versed in her field. It is impossible, however, for every person to enjoy perfect knowledge of every subject. In the world of investing, there is nearly an infinite amount to learn and know, and even the most successful investors don't master all disciplines. In microeconomics, a state of perfect information is assumed in some models of perfect competition. That is, assuming all agents are rational and have perfect information, they will choose the best products; the market will then reward those who make the best products with higher sales accordingly. Perfect information would mean that all consumers know all things about all products at all times; therefore, they would always make the best decision regarding purchases. In competitive markets, unlike in game-theory models, perfect competition does not require that agents have complete knowledge about the actions of others. Rather, in competitive markets, it is assumed that all relevant information is reflected in prices.

2.1.4 Risk Aversion

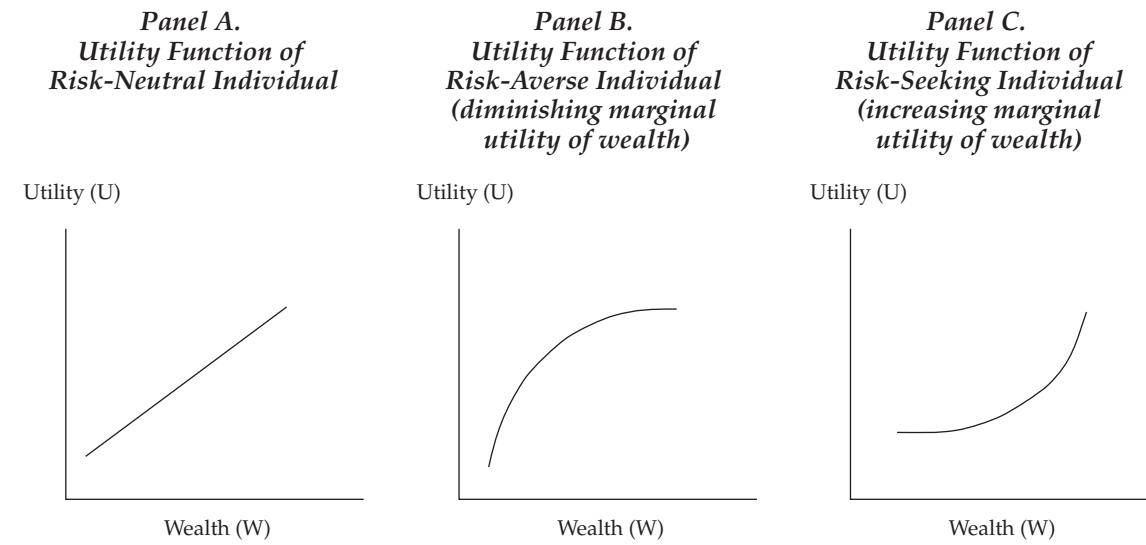
Expected utility theory generally assumes that individuals are risk-averse. This means that an individual may refuse a fair wager (a wager with an expected value of zero), and also implies that his utility functions are concave and show diminishing marginal utility of wealth. Given two choices—investing to receive an expected value with certainty or investing in an uncertain alternative that generates the same expected value—someone who prefers to invest to receive an expected value with certainty rather than invest in the uncertain alternative that generates the same expected value is called risk-averse. Someone who is indifferent between the two investments is called risk-neutral. Someone who prefers to invest in the uncertain alternative is called risk-seeking. In traditional finance, individuals are assumed to be risk-averse.

Following is an example that demonstrates risk neutrality, risk aversion, and risk-seeking. Let's assume a person is given the choice between two scenarios. In the guaranteed scenario, the person receives \$100. In the uncertain scenario, a coin is flipped to decide whether the person receives \$200 or nothing. The expected payoff for both scenarios is \$100. A person who is insensitive to risk or risk-neutral will be indifferent between the guaranteed payment and the coin flip. A person is risk-averse if he or she would accept a payoff of less than \$100 with certainty rather than take the coin flip. A person is risk-seeking (or risk-loving) if the guaranteed payment has to be more than \$100 to induce him to take the guaranteed option rather than the coin flip, where he could possibly win \$200.

An alternative example to demonstrate risk aversion, risk neutrality, and risk-seeking involves determining how much a person is willing to pay to participate in the uncertain scenario. If the person is willing to pay \$100 (the expected payoff), the person is risk-neutral. If the person is willing to pay less than \$100, the person is risk-averse. If the person is willing to pay more than \$100, the person is risk-seeking.

Given an opportunity to participate or to forgo to participate in an event for which the outcome, and therefore his or her receipt of a reward, is uncertain, the **certainty equivalent** is the maximum sum of money a person would pay to participate or the minimum sum of money a person would accept to not participate in the opportunity. The difference between the certainty equivalent and the expected value is called the risk premium. Certainty equivalents are used in evaluating attitudes toward risk.

Risk attitudes toward wealth are reflected in the curvature of the individual's utility function of wealth. As shown in Exhibit 2, risk-neutral individuals have linear utility functions; risk-averse individuals have concave utility functions; and risk-seeking individuals have convex utility functions. A linear utility function means that utility increases at a constant rate with increases in wealth; the risk-neutral individual has a constant marginal utility of wealth. A concave utility function means that utility increases at a decreasing rate with increases in wealth; the risk-averse individual has a diminishing marginal utility of wealth. A convex utility function means that utility increases at an increasing rate with increases in wealth; the risk-seeking individual has an increasing marginal utility of wealth. The degree of risk aversion can be measured by the curvature of the utility function.

Exhibit 2 Utility Function of Wealth

As stated previously, expected utility theory generally assumes that individuals are risk-averse. This implies that utility functions are concave and exhibit diminishing marginal utility. A commonly cited example to demonstrate diminishing marginal utility is a favorite food or beverage. The first taste may give great pleasure (high utility), but each subsequent taste may generate less pleasure; in fact, excessive consumption may lead to discomfort (disutility). Although there may be no discomfort associated with increasing wealth, one can imagine a situation in which an incremental increase to wealth generates less increased utility than a previous increase to incremental wealth. For example, sufficient wealth to pay for housing has a very positive utility, but the extra wealth to pay for a third or fourth home may have a much smaller positive impact on utility. Thus, assuming that individuals are risk-averse and that utility curves are concave and exhibit diminishing marginal utility seems reasonable.

2.2 Behavioral Finance Perspectives on Individual Behavior

Behavioral finance challenges the assumptions of traditional finance based on observed behaviors. The assumptions of traditional finance with respect to the behaviors of individuals are not universally observed to hold true. Investors do not necessarily make decisions consistent with utility theory and revise expectations (update beliefs) consistent with Bayes' formula. They may exhibit behavior that is not self-interested or risk-averse. They do not have access to perfect information and may not process all available information.

In contrast to ideas of perfect rationality or utility maximization, behavioral finance attempts to identify and learn from human psychological phenomena at work within individual market participants. The impact of psychological phenomena on individual market participants may then, in turn, impact financial markets. Behavioral finance, like traditional finance, is guided by basic precepts and assumptions. However, behavioral finance grounds its assumptions in observed financial behavior rather than in idealized financial behavior. For example, behavioral finance examines mental processes, such as the fear of loss or the human tendency to overestimate low-probability events. Some of the behavioral challenges to the assumptions of traditional finance are discussed in the following sections.

2.2.1 Challenges to Rational Economic Man

The validity of rational economic man (REM) has been the subject of much debate since the model's introduction. Those who challenge REM do so by attacking the basic assumptions of perfect information, perfect rationality, and perfect self-interest. Keynes (1936) contends that no human can be fully informed of "all circumstances and maximize his expected utility by determining his complete, reflexive, transitive, and continuous preferences over alternative bundles of consumption goods at all times." Keynes acknowledges the inherent limitations of people in making decisions.

Bounded rationality (discussed further in section 3.2) is proposed as an alternative to the assumptions of perfect information and perfect rationality. It relaxes the assumptions of expected utility theory and perfect information to more realistically represent human economic decision making. Bounded rationality assumes that individuals' choices are rational but are subject to limitations of knowledge and cognitive capacity. Bounded rationality is concerned with ways in which final decisions are shaped by the decision-making process itself.

A shortcoming of the theory of rational economic man is that it disregards the inner conflicts that real people face. For instance, rational economic man does not account for the fact that people can have difficulty prioritizing short-term versus long-term goals (e.g., spending versus saving) and do not behave with perfect self-interest. People instead seem to try to reconcile short-term and long-term goals with individual goals and societal values. This may result in inner conflicts, and these conflicts may lead to behavior that is not rational as defined in traditional finance.

Perhaps the strongest criticisms of REM challenge the underlying assumption of perfect information. It is intuitively obvious that many economic decisions are made in the absence of perfect information. For example, some economic theories assume that people adjust their buying habits based on the monetary policy of central banks. Although some people may know how to find the central bank data, interpret it, and apply it, many do not even know the roles of central banks. This one example demonstrates the implausibility of the idea that all participants in financial markets possess or act as if they possess perfect information.

The concept of rational economic man is appealing to financial theorists for two primary reasons. First, assuming decision making by REM simplifies economic models and analysis, because it is easier to model human behavior given this assumption. Second, this allows economists to quantify their findings, making their work easier to understand. If humans are perfectly rational and self-interested and possess perfect information, then quantifying their behavior may be feasible. However, human rationality covers a spectrum from that which appears perfectly rational to that which appears irrational. Individuals are neither perfectly rational nor perfectly irrational; instead, they possess diverse combinations of rational and irrational characteristics and benefit from different degrees of knowledge. The extent to which any one individual appears to be behaving rationally can vary between decisions depending on a variety of factors, including the type of decision, the extent of the individual's knowledge, and the particular circumstances. Even if individuals do not behave rationally, the idea of REM is useful because it is normative and helps define an optimal outcome.

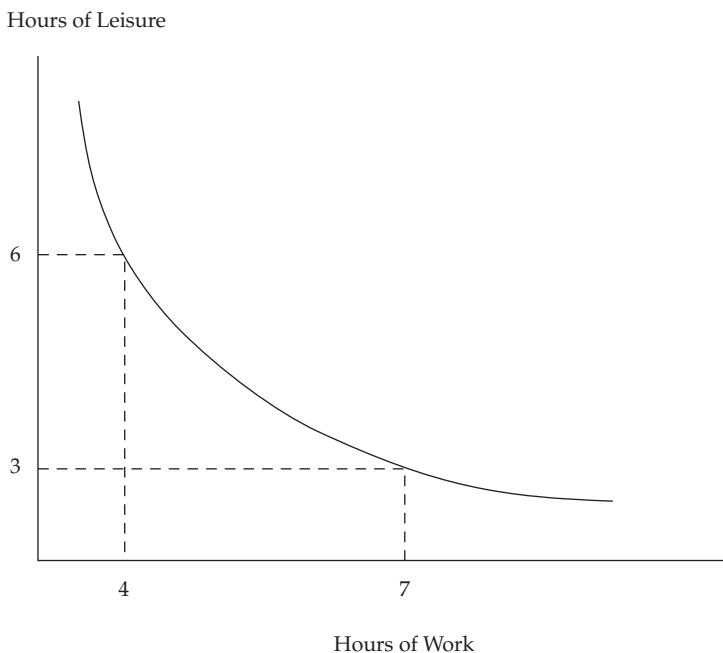
2.2.2 Utility Maximization and Counterpoint

A useful way to assess the validity of rational economic theory is to use indifference curves. The aim of indifference curve analysis is to demonstrate, mathematically and graphically, the basis on which a rational consumer substitutes certain quantities of one good for another. For example, it is possible to model the effects of a wage adjustment on a worker's allocation of hours to work versus leisure. **Indifference curve analysis** may incorporate budget lines or constraints, which represent restrictions on consumption that stem from resource scarcity. In the work-versus-leisure model, for

example, workers may not allocate any sum exceeding 24 hours per day. The number of hours available for work and leisure may be lower than 24 hours depending on other demands on their time.

An indifference curve, as shown in Exhibit 3, depicts all of the possible combinations of two goods amongst which an individual is indifferent.⁷ This individual appears to have a constraint of 10 hours available for work and leisure. Consuming any bundle on the curve shown yields the same level of utility for the individual. In Exhibit 3, the individual would achieve equal satisfaction with four hours of work and six hours of leisure or with seven hours of work and three hours of leisure. The indifference curve shows the marginal rate of substitution, or the rate at which a person is willing to give up one good for another, at any point. If the two items are perfect substitutes, then the individual is willing to trade one for the other in a fixed ratio; then, the indifference curve is a line with a constant slope reflecting the marginal rate of substitution. If the two items are perfect complements, then the curve would be L-shaped. An additional amount of either good adds no extra utility because the goods are only used in combination.

Exhibit 3 Trade-Off between Work and Leisure



Utility theory should also consider such other factors as risk aversion, probability, size of the payout, and the different utility yielded from the payout based on the individual's circumstances. For example, in a period of high unemployment, an individual may be competing with many others for a job. Under these circumstances, the individual may be willing to work 10 hours a day with no leisure. The trade-off between work and leisure hours is impacted by exogenous factors.

Although indifference curve analysis is theoretically sound, is an individual likely to calculate and perform mathematical equations to determine the trade-off between work and leisure on an ongoing basis? Some might, but many would not. The failure to consider exogenous factors in rational utility analysis is also problematic. Furthermore,

⁷ Note that the intercept of the axes as shown (the origin) is not (0, 0).

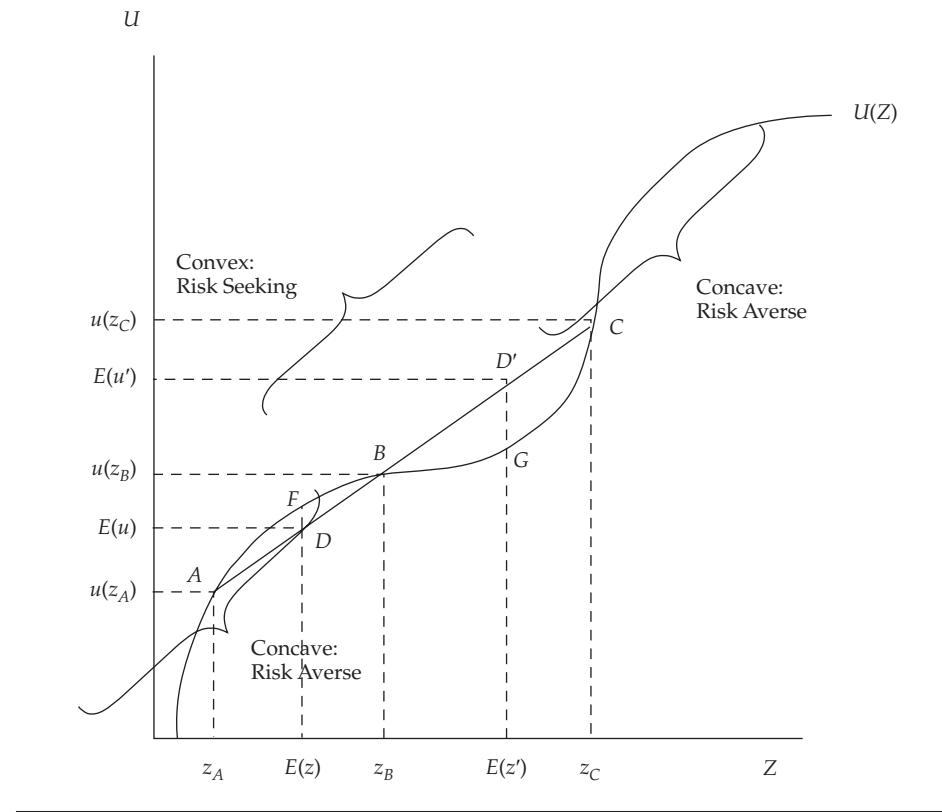
risk needs to be accounted for. What is this individual's risk of job loss if he or she does not work eight hours a day? Risk plays an important part in making utility-maximizing decisions. Risk aversion is an assumption underlying actions taken by REM.

2.2.3 Attitudes Toward Risk

Assuming that individuals are risk-averse and that utility curves are concave and exhibit diminishing marginal utility seems reasonable, but observed behaviors are not always consistent with the assumption of an individual who is constantly risk-averse. For example, anyone who has ever purchased a lottery ticket has displayed risk-seeking behavior that is inconsistent with the rational risk-averse behavior assumed in traditional finance. Friedman and Savage (1948) discuss behaviors that seem to contradict the traditional finance beliefs that individuals always seek to maximize the utility of their money and are risk-averse. They cite examples, such as buying lottery tickets and buying insurance, in which expected utility is low but people (even with low incomes) participate in the purchase. The authors find that generally people must be paid a premium to be induced to take moderate risks. However, if an investment offers a few extremely large prizes, its attractiveness is increased far beyond the aggregate value of the prizes. They also find a difference between individuals at different income levels. Those with less income prefer either certainty or a risk that offers a small chance of a large gain to a risk that is moderate. Middle-income people are more likely to be attracted by small, fair gambles.

Perhaps the most important concept we can learn here is that risk evaluation is reference-dependent, meaning risk evaluation depends in part on the wealth level and circumstances of the decision maker. Friedman and Savage indicate that it is not necessarily true that an individual's utility function has the same curvature consistently: There may be levels of wealth, for instance, at which an investor is a risk-seeker and levels of wealth where the investor is risk-neutral. Also, circumstances may vary. As shown in Exhibit 4, the Friedman–Savage **double inflection utility function**, $u(z)$, is concave up to inflection point B , then becomes convex until inflection point C , after which it becomes concave again. Thus, at low income levels (between the origin and z_B), agents exhibit risk-averse behavior; they are also risk-averse at high income levels (above z_C). However, between the inflection points B and C , agents are risk-loving.

Double Inflection Utility Function—A utility function that changes based on levels of wealth.

Exhibit 4 Friedman–Savage Double-Inflection Utility Function

Friedman and Savage try to explain why people may take low-probability, high-payoff risks (e.g., lottery tickets), while at the same time insuring against low risks with low payoffs (e.g., flight insurance). To see this, presume one is at inflection point B between risk-averse and risk-seeking. Suppose one faces two lotteries, one yielding A or B , another yielding B or C . These lotteries are captured by the solid line segments between the respective payoffs AB and BC . Expected utility of the first gamble is denoted as $E(u)$ and is depicted in Exhibit 4 at point D —where, obviously, $E(u)$ is less than the utility of the expected outcome of the first gamble, $u[E(z)]$, depicted at point F . Consequently, a risk-averse agent would pay a premium to avoid it. The second gamble yields expected utility $E(u')$ at point D' on the BC segment, which is greater than the utility of the expected outcome $u[E(z')]$, depicted at point G . A risk-seeking agent would *pay* a premium to undertake this gamble. Thus, we can view risk-averse behavior with regard to AB as a case of insurance against small losses and the risk-seeking behavior with regard to BC as a case of purchasing lottery tickets.

Prospect theory (discussed further in section 3.3) has been proposed as an alternative to expected utility theory.⁸ Prospect theory assigns value to gains and losses (changes in wealth) rather than to final wealth, and probabilities are replaced by decision weights. In prospect theory, the shape of a decision maker's value function is assumed to differ between the domain of gains and the domain of losses. The value function is defined by deviations from a reference point and is normally concave for gains (implying risk aversion), convex for losses (risk-seeking), and steeper for losses than for gains (loss aversion). Decision weights are generally lower than the corresponding probabilities, except in the range of low probabilities.

⁸ See Kahneman and Tversky (1979).

It appears that the assumptions of traditional finance with respect to the behaviors of individuals are not universally observed to hold true. Investors do not necessarily make decisions consistent with utility theory and revise expectations (update beliefs) consistent with Bayes' formula. They may exhibit behavior that is not self-interested or risk-averse. They may not have access to perfect information and may not process all available information.

2.3 Neuro-economics

Behavioral finance, drawing on psychology, observes behaviors in an attempt to understand and explain how investors and markets behave. Neuro-economics combines neuroscience, psychology, and economics in attempting to explain how humans make economic decisions. Neuro-economics is an emerging field of study relevant to understanding how people make economic decisions under uncertainty. Neuro-economics attempts to explain investor behavior based on the functioning of the brain.

Neuro-economics uses imaging of brain activity and other techniques in combination with experimental economics to study the neural basis of economic decision making. By comparing the blood flow to and activity in different parts of the brain before, during, and after a task, it is possible to associate certain regions of the brain with performance of the task. In addition, chemical levels in the brain are studied to gain insights into responses to events and activities. Neuro-economics attempts to bridge the gap between research on decision behavior and economic theory by understanding the brain activity of judgment and making choices.

Glimcher (2003) described the goal of his research as follows: "The long-term goal of my research is to describe the neural events that underlie behavioral decision making. Our approach to this problem consolidates mathematical economic approaches to decision making with traditional neurobiological tools. By using these tools in our physiological analyses of the brainstem, cortex, and the basal ganglia, we hope to develop a coherent view of how the brain makes decisions."⁹

By observing brain activity, neuro-economics attempts to answer such questions as, "How do emotions affect judgment and decision making? How do people perceive uncertainty? How does risk affect human decision making?" Traditional finance attempts to answer similar questions by making simplifying assumptions. Behavioral finance attempts to answer similar questions by observing behaviors and inferring the basis for the behavior. These approaches each potentially provide insights into financial decision making and should not be viewed as mutually exclusive.

Critics of neuro-economics claim that, although the results of neuro-economics may be interesting, there have been few insights from neurobiological studies that constrain economic theory. Gul and Pesendorfer (2008) argue that neurobiological measurements, *per se*, are entirely outside the scope of economics. Economic theory makes predictions about behavior, and the actual functioning of the brain during decision making is irrelevant. In short, they argue that insights into biological mechanisms, such as brain activity or chemical levels in the brain, are unlikely to have an impact on economic theory.

Perhaps some of the more interesting insights result from examining chemical levels in the brain. Dopamine and serotonin are chemicals naturally produced in the body. Dopamine functions as a neurotransmitter and is commonly associated with the pleasure system, providing feelings of enjoyment and reinforcement to motivate people to do or continue certain activities. A reduction in serotonin in the body is often linked to such emotional and behavioral problems as anxiety, depression, impulsiveness, and irritability.

⁹ Glimcher (2003).

Dopamine is released in response to both a reward and the expectation of a reward. The release of dopamine after an expected or unexpected reward and the desire for dopamine release may explain risk-taking behavior. The prospect of a euphoric effect may inhibit people from focusing on the more logical thought of how small the odds of a reward (positive outcome) actually are. In this context, it is not difficult to imagine that dopamine may explain such behavioral biases as overconfidence and may also play a role in market overreaction to short-term results.

If an expected reward fails to arrive, dopamine is not released and dopamine levels decline, which may result in a depressed state. Further, unfulfilled expectations depress brain serotonin levels. The resulting emotional state may impact investors in a variety of ways: It may prevent the investors from taking further actions that involve assuming risk or it may cause investors to become impulsive and attempt to recoup losses by employing high-risk investing strategies (usually resulting in excessive trading).

Research focusing on the roles played by areas of the brain also provides insights into human behavior. For example, the amygdala plays a key role in emotions, such as fear and pleasure. It is the amygdala that creates a “fight or flight” response during a sudden event or trauma. For investors, the amygdala may be responsible for a panicked response rather than an analytical response to a dropping market. Although neuroeconomics research is interesting and may provide further insights into individual economic decision making, its effect on economic theory remains to be seen.

3

DECISION MAKING

This section examines behavioral theories developed in response to the relaxing of particular assumptions about individual behavior with respect to decision making. Prospect theory relaxes the assumptions of expected utility theory and risk aversion. Bounded rationality relaxes the assumption that all available information is used to arrive at a wealth-maximizing decision. Before discussing prospect theory and bounded rationality, which are based on observations of how people actually do seem to make decisions, we will discuss theories of how people should make decisions. Prospect theory and bounded rationality are descriptive, describing how people *do* behave and make decisions. Expected utility and decision theories are normative, describing how people *should* behave and make decisions.

3.1 Decision Theory

Decision theory is concerned with identifying values, probabilities, and other uncertainties relevant to a given decision and using that information to arrive at a theoretically optimal decision. Decision theory is normative, meaning that it is concerned with identifying the ideal decision. As such, it assumes that the decision maker is fully informed, is able to make quantitative calculations with accuracy, and is perfectly rational. The practical application of decision theory is prescriptive. It analyzes decisions and attempts to provide tools and methods to help people make better decisions.

From a historical perspective, the initial focus of decision theory was on expected value. The first person to record explorations of expected value was Blaise Pascal, a French mathematician and philosopher in the 1600s who is also known for his wager

on the existence of God.¹⁰ In 1670, Pascal discussed expected value and choice in this way: “When faced with a number of actions, each of which could give rise to more than one possible outcome with different probabilities, the rational procedure is to identify all possible outcomes, determine their values (positive or negative) and the probabilities that will result from each course of action, and multiply the two to give an expected value. The action to be chosen should be the one that gives rise to the highest total expected value.”¹¹

Bernoulli (1954) describes the difference between expected utility and expected value.¹² Expected value of an item is based on its price, which is the same for everyone because the price depends only on the item itself. Expected utility of an item is based on the worth assigned to it by the person making the estimate; as a result, it may vary from person to person because it depends on each person’s circumstances. Bernoulli’s theory of expected utility, which includes the premise that utility increases at a decreasing rate with increases in wealth, is one of the theories that supports traditional finance perspectives.

Frank Knight (1921) makes important distinctions between risk and uncertainty. He defines risk as randomness with knowable probabilities and uncertainty as randomness with unknowable probabilities. Knight argues that situations with risk, such as decision making with unknown outcomes but known ex-ante probability distributions, differ from situations with uncertainty, such as decision making with unknown outcomes and probabilities. He contends that situations in which decision-making rules, such as maximizing expected utility, can be applied differ in a substantial way from those in which they cannot, such as when the probability distribution of a random outcome is unknown. Risk is measurable, but uncertainty is not.

von Neumann and Morgenstern (1944) posit that a rational decision maker makes decisions consistent with the axioms of utility theory and chooses the combination of decisions that maximize expected utility. Savage (1954) introduces subjective expected utility (SEU). The theories of von Neumann and Morgenstern and Savage extend the scope of expected utility theory to situations in which only subjective probabilities are available. SEU theory extends the conditions of perfect utility-maximizing rationality to a world in which the probability distributions of all relevant variables can be provided by the decision makers.

In order to take SEU theory and apply it to actual decision making, prescriptive theories of choice should consider the empirical evidence as to how people actually make decisions. Prescriptive approaches based on SEU theory consider empirical evidence as to the limits on human rationality. These limitations are imposed by the complexity of the world we live in, the incompleteness and inadequacy of human knowledge, the computational inadequacy of people, the inconsistencies of individual preference and beliefs, and the conflicts of value among individuals and groups.

Descriptive analysis of problem solving and decision making are centrally concerned with how people manage to reduce complicated problems to a cognitively manageable size, with how they approximate and heuristically handle complexity. Descriptive analyses make it possible to develop theories and practices that account for the unrealistic parts of SEU theory. These theories illustrate how people respond

¹⁰ “Pascal’s wager” is a classic example of a choice under uncertainty. The uncertainty is whether God exists. Belief or non-belief in God is the choice to be made. Pascal argues that the reward for belief in God if God actually does exist is infinite, while the cost of believing in God if God actually does not exist is low. Therefore, the expected value of belief exceeds that of non-belief, so Pascal contends that it is prudent to believe in God.

¹¹ Pascal’s *Pensées* by Blaise Pascal (1670).

¹² Bernoulli’s article was originally published in 1738. The 1954 version is a re-publication.

to complexity and limitations, while striving to achieve results that approximate the ideal (i.e., the results of normative theories). Bounded rationality and prospect theory are examples of such theories.

Bounded rationality theory relaxes the assumptions that perfect information is available and that all available information is processed according to expected utility theory. Bounded rationality acknowledges that individuals are limited in their abilities to gather and process information. Prospect theory relaxes the assumptions that individuals are risk-averse and make decisions consistent with expected utility theory. Prospect theory assumes that individuals are loss-averse.

3.2 Bounded Rationality

Simon (1957) proposed the notion of **bounded rationality**, recognizing that people are not fully rational when making decisions and do not necessarily optimize but rather satisfice (defined below) when arriving at their decisions. People have informational, intellectual, and computational limitations. Even supplementing the capabilities of individuals with computers, humans may not be able to make fully informed and rational decisions. Simon introduced the terms *bounded rationality* and *satisfice* to describe the phenomenon where people gather some (but not all) available information, use heuristics¹³ to make the process of analyzing the information tractable, and stop when they have arrived at a satisfactory, not necessarily optimal, decision. In contrast to rational economic man making decisions according to expected utility theory, Simon describes individuals who are satisfied to gather what they deem to be enough information, who will process the information in ways they deem adequate, who are prone to identify with sub-goals and limited objectives rather than try to achieve an optimum, and who will stop when they have a decision that fits within parameters they deem satisfactory.¹⁴

Bounded rationality sets parameters on how much will be done in making a decision and within which decisions will be deemed as satisfactory. The term **satisfice** combines “satisfy” and “suffice” and describes decisions, actions, and outcomes that may not be optimal, but they are adequate.¹⁵ To satisfice is to find a solution in a decision-making situation that meets the needs of the situation and achieves the goals of the decision maker. Satisficing is finding an acceptable solution as opposed to optimizing, which is finding the best (optimal) solution. The optimal solution is the one that maximizes the utility realizable from the situation. Individuals lack the cognitive resources to arrive at optimal solutions. For example, individuals typically do not know the relevant probabilities of the potential outcomes, can rarely identify or evaluate all outcomes, and have weak and unreliable memories.

Decision makers may choose to satisfice rather than optimize because the cost and time of finding the optimal solution can be very high. In these circumstances, satisficing creates a stop rule to the decision process and allows the cost incurred and time taken to be limited. Another reason for decision makers to use satisficing is that even when people can continue evaluating exhaustive alternatives and cost is not a factor, they still need to find new alternatives and their expected outcomes. This search for an optimum will often become so complicated and time consuming that it is eventually infeasible. The empirical evidence in Simon’s studies suggests that consumers, employees, and business people typically satisfice rather than optimize.

¹³ Heuristics are mental shortcuts based on experience and knowledge that simplify decision making. They are sometimes called “rules of thumb.”

¹⁴ See Simon (1991).

¹⁵ See Simon (1996).

The reason behind this is bounded rationality. It is infeasible to generate all possible alternatives, estimate the probability of each possible outcome of each alternative, and define consistent utility functions for every alternative prior to making a decision.

Instead of looking at every alternative, people set constraints as to what will satisfy their needs. These constraints indicate what is aspired to. This is not a minimum acceptable outcome but a satisfactory acceptable outcome. Simon refers to these constraints as aspiration levels. Aspiration levels are set based on experiences and on comparisons with what other individuals have achieved. People tend to aspire for a future that is better than the past. When aspirations are reached, people tend to adjust the aspirations upward; when aspirations are not reached, people tend to adjust downward.

When searching for alternative solutions to an issue or problem, decision makers may use heuristics to guide their search. Although using heuristics may simplify the search for alternatives, they also may result in alternatives being missed (not identified). Rather than taking a holistic approach, heuristics may use more of an incremental approach. An example of heuristics is means-ends analysis, where the problem solver is at a current state and decides on the goal state. Rather than looking for alternatives to achieve the goal, the decision maker moves toward the goal in stages. Decisions are made progressively until the goal state is achieved: The first decision is made to get one step closer to the goal state, the next decision results in getting still closer to the goal, and decisions continue to be made until the goal state is met. Another example is the divide-and-conquer procedure, where a problem or issue is divided into components. In this case, rather than attempt to find alternatives to solve the issue or problem, the decision makers attempt to find satisfactory solutions for each sub-problem.

An accepted principle of decision making is to attend to only the most important aspects of the situation. When evaluating alternatives, an investor needs to be aware of the surrounding economic and political environment. An investor needs to have an in-depth understanding of the aspiration levels and satisficing heuristics of business people, government officials, and other investors. One is rarely able to use optimization to determine what is best for a portfolio. Alternatives are almost infinite, and accurately estimating an outcome for each alternative is extremely difficult and both cost and time prohibitive. Because investors have only a limited capacity to assess alternatives and outcomes, they act within the constraints of bounded rationality. Thus, portfolio decisions are based on a limited set of factors, such as economic indicators, deemed most important to the end goal. When the alternatives are limited, a person can dedicate more time to evaluating the most likely outcomes to help make decisions that will satisfice the investment goals.

A decision maker is said to exhibit bounded rationality when he violates some commonly accepted precept of rational behavior but nevertheless acts in a manner consistent with the pursuit of an appropriate set of goals or objectives. Although this definition specifies neither the precept being violated nor conditions under which a set of goals may be considered appropriate, it is still usable.

EXAMPLE 2

Bounded Rationality

Harry Timmons has cash that he wishes to earn interest on, have accessible, and protect against loss. He is aware that the amount of cash to be deposited will be fully insured by a corporation backed by the government if it is deposited in an eligible account at an insured member institution. He has decided to deposit the funds in a checking account at the bank down the street. The bank clearly posts on its door that it is a member institution and only offers eligible accounts. The account will pay 0.25 percent.

Explain how this decision has violated rational behavior but is consistent with bounded rationality.

Solution:

Timmons did not behave totally rationally because he did not gather full information to identify a listing of insured members and what types of accounts are eligible. There may be other institutions that offer eligible accounts that pay higher interest. Further, he did not search for alternatives to depositing in an eligible account with a member institution that met his criteria.

Timmons' behavior is boundedly rational because his decision meets the criteria specified but is not necessarily optimal. Although the decision is undoubtedly suboptimal because higher returns may have been possible, it satisfies within the totality of the investor's decision-making environment. Timmons may have decided he had neither the time nor the resources to research all alternatives. Given the investor's apparently limited knowledge of alternatives, and considering time constraints and the three criteria (interest, accessibility, and loss protection), depositing in a fully insured checking account at 0.25 percent may be reasonable.

3.3 Prospect Theory

Kahneman and Tversky (1979) introduce prospect theory as an alternative to expected utility theory. Prospect theory describes how individuals make choices in situations in which they have to decide between alternatives that involve risk (e.g., financial decisions) and how individuals evaluate potential losses and gains. Prospect theory considers how prospects (alternatives) are perceived based on their framing, how gains and losses are evaluated, and how uncertain outcomes are weighted.

In prospect theory, based on descriptive analysis of how choices are made, there are two phases to making a choice: an early phase in which prospects are framed (or edited) and a subsequent phase in which prospects are evaluated and chosen. The framing (editing phase) consists of using heuristics to do a preliminary analysis of the prospects, often yielding a simpler representation of these prospects. More specifically, people decide which outcomes they see as economically identical and then establish a reference point to consider where these prospects rate. Outcomes below the reference point are viewed as losses, and those above the reference point are gains. In the second phase, the edited prospects are evaluated and the prospect of highest perceived value is chosen.

During the editing or framing stage, alternatives are ranked according to a basic heuristic that was identified and chosen by the decision maker. This contrasts with the elaborate algorithms of expected utility theory. Framing refers to the way a choice option or prospect can be affected by the way in which it is presented. Understanding that how choices are presented or framed impacts the final choice is a critical aspect of prospect theory. In many situations, a decision maker does not know all the options available. Depending on the number of prospects, there may be up to six operations in the editing process: codification, combination, segregation, cancellation, simplification, and detection of dominance. In the process, individuals identify their options, and choice can be affected by how that identification is done. The ultimate purpose behind editing is to simplify the evaluation of choices available by reducing the choices to be more thoroughly evaluated. People use editing when making choices because of cognitive constraints.

The following are examples of six operations in the editing process.¹⁶ Some editing operations will permit or prevent others from being carried out. The sequence of editing operations is likely to vary with the offered set and the format of the display. In the editing phase, a decision maker organizes and reformulates the available options to simplify the choice.

- *Codification:* People perceive outcomes as gains and losses rather than final states of wealth or welfare. A gain or loss is, of course, defined with respect to some reference point. The location of the reference point affects whether the outcomes are coded as gains or losses. Prospects are coded as (gain or loss, probability; gain or loss, probability; ...) such that the probabilities initially add to 100 percent or 1.0.
- *Combination:* Prospects are simplified by combining the probabilities associated with identical gains or losses. For example, a prospect initially coded as (250, 0.20; 200, 0.25; 200, 0.15; 150, 0.40) will be simplified to (250, 0.20; 200, 0.40; 150, 0.40).
- *Segregation:* The riskless component of any prospect is separated from its risky component. For example, a prospect initially coded as (300, 0.8; 200, 0.2) is decomposed into a sure gain of (200, 1.0) and a risky prospect of (100, 0.8; 0, 0.20). The same process is applied for losses.

The above operations are applied to each prospect separately. The following operations are applied to two or more prospects:

- *Cancellation:* Cancellation involves discarding common outcome probability pairs between choices. For example, the pairs (200, 0.2; 100, 0.5; 20, 0.3) and (200, 0.2; 300, 0.4; -50, 0.4) are reduced to (100, 0.5; 20, 0.3) and (300, 0.4; -50, 0.4).
- *Simplification:* Prospects are likely to be rounded off. A prospect of (51, 0.49) is likely to be seen as an even chance to win 50. Also, extremely unlikely outcomes are likely to be discarded or assigned a probability of zero.
- *Detection of Dominance:* Outcomes that are strictly dominated are scanned and rejected without further evaluation.

Preference anomalies may arise from the act of editing. An example of a preference anomaly is the isolation effect. This results from the tendency of people to disregard or discard outcome probability pairs that the alternatives share (cancellation) and to focus on those which distinguish them. Because different choice problems can be decomposed in different ways, this can lead to inconsistent preferences.

The following is an example of the isolation effect.¹⁷ Experimental subjects were given the choice of Gambles A and B.

- Gamble A: A 25 percent chance of receiving \$3,000 and a 75 percent chance of receiving nothing.
- Gamble B: A 20 percent chance of receiving \$4,000 and an 80 percent chance of receiving nothing.

Sixty-five percent of the experimental subjects chose Gamble B. The expected value of Gamble B is \$800 compared to an expected value of \$750 for Gamble A, so it is not surprising that the majority of subjects chose Gamble B.

¹⁶ Readers should note that there is ongoing work in the area of prospect theory. There have been many papers written on this theory that include examples of the editing and evaluation phases. The examples here are merely presented as an overview.

¹⁷ This example comes from the Experimental Economics Center at Georgia State University in Atlanta.

Next, the experimental subjects were given a two-stage gamble. The first stage involves a 0.75 probability of ending the game without winning or losing anything and a 0.25 probability of moving to the second stage. The second stage involves a choice between Gambles C and D. The choice of Gamble C or D had to be made prior to the first stage.

- Gamble C: A 100 percent chance of receiving \$3,000.
- Gamble D: An 80 percent chance of receiving \$4,000 and a 20 percent chance of receiving nothing.

Seventy-eight percent of the experimental subjects chose C.

The fact that 65 percent of the subjects chose B in the first gamble and 78 percent chose C in the second gamble is viewed as surprising. It is surprising because the true probabilities and expected values of Gambles C and D in the two-stage gamble are respectively the same as those of Gambles A and B in the first gamble. In the two-stage gamble, the majority of subjects chose the gamble with the lower expected value.

- Gamble C: $0.25 \times 1.0 = 25$ percent chance of receiving \$3,000 and a 75 percent chance of receiving nothing.
- Gamble D: $0.25 \times 0.8 = 20$ percent chance of receiving \$4,000 and an 80 percent chance of receiving nothing.

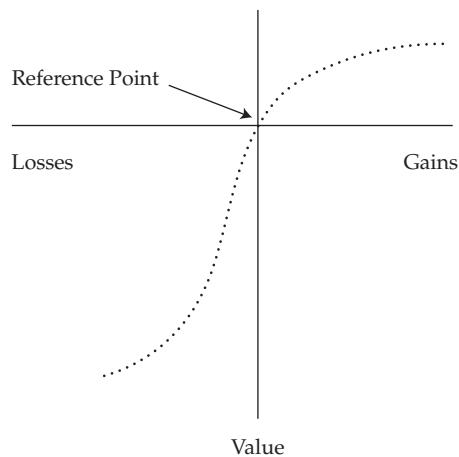
Clearly, how the prospects were framed had an effect on the choice. Kahneman and Tversky interpret this finding in the following manner: To simplify the choice between alternatives, people frequently disregard components that the alternatives share and instead focus on those that distinguish them. Because different choice problems can be decomposed in different ways, inconsistent preferences can result, as above. They call this phenomenon the isolation effect.

3.3.1 The Evaluation Phase

In the evaluation phase of prospect theory, people behave as if they compute a value (utility) function based on the potential outcomes and their respective probabilities and then choose the alternative that has a higher utility. For this evaluation process, Kahneman and Tversky assume the following formula:

$$U = w(p_1)v(x_1) + w(p_2)v(x_2) + \dots$$

where $x_1, x_2 \dots$ are the potential outcomes and $p_1, p_2 \dots$ their respective probabilities; v is a function that assigns a value to an outcome; and w is a probability-weighting function. The probability-weighting function expresses the fact that people tend to overreact to small probability events but underreact to mid-sized and large probabilities. The value function (see Exhibit 5), which passes through the reference point, is s-shaped; moreover, as its asymmetry implies, given the same variation in absolute value there is a bigger impact of losses than of gains (loss aversion). People are not risk-averse but rather are loss-averse.

Exhibit 5 Value Function

A quantitative illustration of the evaluation process is complex and not necessary to review here. What is important to know is that the quantitative elements resemble those of expected utility theory, although there are some important differences. Values are attached to changes rather than final states, and the decision weights need not coincide with probabilities. Experimental evidence shows that most people reject a gamble with even chances to win and lose, unless the amount of the possible win is at least twice the amount of the possible loss. In contrast to expected utility theory, the prospect theory value function measures gains and losses but not absolute wealth and is reference-dependent. Reference dependence is incompatible with the standard interpretation of expected utility theory. Reference dependence is a feature of prospect theory and is central to prospect theory's perspective on how people make decisions under uncertainty.

Kahneman and Tversky illustrate reference dependence with an example. People are presented with the following two situations and asked to make choices.

Situation 1 Given a 50 percent probability of winning \$150 and a 50 percent probability of losing \$100, is an individual likely to take this gamble? Is the individual's choice likely to change if overall wealth was lower by \$100?

There will be few takers of the gamble because experimental evidence shows that most people reject a gamble with even chances to win and lose, unless the possible win is at least twice the size of the possible loss. In this case, the answer to the second question is negative.

Situation 2 Given the choice of losing \$100 with certainty and a gamble with a 50 percent probability of winning \$50 and a 50 percent probability of losing \$200, which is an individual likely to choose? Would the individual's choice change if overall wealth were higher by \$100?

In situation 2, the gamble may appear more attractive than the sure loss. Experimental results indicate that risk-seeking preferences are held by a large majority of respondents in choices of this kind. Here again, a change of \$100 in total wealth is unlikely to alter preferences. Situations 1 and 2 evoke different preferences, but the difference is caused by a framing effect. In both cases, the gamble compared to the certain position provides an expected net gain of \$25 {Situation 1 = $E[\text{gain}]$ of

gamble] – E[certainty] = \$25 – \$0 = \$25; Situation 2 = –\$75 – (–\$100) = \$25}. The situations differ only in that all values are lower by \$100 in situation 2. This should be an inconsequential variation.

Kahneman and Tversky examined many choice pairs of this type early in their explorations of risky choice, and they concluded that the abrupt transition from being risk-averse to risk-seeking could not plausibly be explained by a utility function for wealth. Preferences appear to be determined by attitudes toward gains and losses, which are defined relative to a reference point that frames the situation. The discarding of components that are common to all prospects (outcomes) may lead to inconsistent preferences depending on the framing of the choice.

Kahneman and Tversky's prospect theory explains apparent deviations in decision making from the rational decisions of traditional finance. These deviations result from overweighting low probability outcomes, underweighting moderate and high probability outcomes, and having a value function for changes in wealth (gains and losses) that is in general concave for gains, convex for losses, and steeper for losses than for gains. As a result, people are risk-averse when there is a moderate to high probability of gains or a low probability of losses; they are risk-seeking when there is a low probability of gains or a high probability of losses. This is consistent with people simultaneously buying lottery tickets and insurance while investing money conservatively.

4

PERSPECTIVES ON MARKET BEHAVIOR AND PORTFOLIO CONSTRUCTION

Traditional finance assumes that, at the market level, prices incorporate and reflect all available and relevant information. Markets that behave in a manner consistent with this assumption are referred to as efficient. Portfolios constructed in accordance with traditional finance assumptions are referred to as optimal. Section 4.1 provides an overview of the traditional finance perspectives of market behavior. Section 4.2 provides a brief overview of the traditional finance perspectives on portfolio construction. Section 4.3 discusses behavioral finance alternatives to the traditional finance perspective of market behavior and portfolio construction.

4.1 Traditional Perspectives on Market Behavior

Much of modern investment theory and practice is predicated on the efficient market hypothesis:

Markets fully, accurately, and instantaneously incorporate all available information into market prices.

However, the efficient market hypothesis (EMH) is not universally accepted. In this section, we will discuss the EMH and explore some of the evidence supporting and opposing it.

Writing in the *Financial Times*, Thaler (2009) comments on two aspects of the EMH. He terms these “The Price is Right” and “No Free Lunch.” The *price is right* assumes that asset prices fully reflect available information and that securities’ prices can be used as a means to allocate resources. Accepting the EMH as fact, and noting the random nature (unpredictability) of prices, some economists infer that prices are

indeed right. Robert Shiller calls this inference “one of the most remarkable errors in the history of economic thought.”¹⁸ The price is right is a fallacy because mere randomness does not ensure that the prices are not wrong.¹⁹

No free lunch assumes that it is difficult for any investor to consistently outperform the market after taking risk into account given the inherent unpredictability of prices. Thaler notes that a myriad of studies over several decades have resulted in the same basic conclusion: There is no free lunch. With the exception of some apparent anomalies, the market is hard to beat. In fact, many of the investment strategies that seemed to beat the market did not do so once risk was more accurately measured.

Thaler concludes that the risks of investments are more correlated than previously thought, that high returns based on high leverage may be transitory and an illusion, and that revealed price distortions challenge the assumption of the price is right. Further, the acceptance of the price is right has led to significant misallocations of resources. However, Thaler leaves us with a quandary: If we abandon the efficient market hypothesis and its assumption that the price is right, how do we allocate resources? Thaler suggests that regulation may serve a useful function in the process of allocating resources.

4.1.1 Review of the Efficient Market Hypothesis

An efficient market is a market wherein prices fully reflect available information because of the actions of a large number of rational investors (the population of investors). Underlying market efficiency is the assumption that market participants are rational economic beings, always acting in their own self-interest and making optimal decisions by trading off costs and benefits weighted by statistically correct probabilities and marginal utilities. The efficient market hypothesis requires that agents have rational expectations. This means that, in aggregate, the population is correct, even if no one person is. Also, whenever new relevant information appears, the population updates its expectations. Another key assumption is that relevant information is freely available to all participants. Competition among participants results in a market wherein prices of individual investments always reflect the total effect of all information—including information about events that have already happened and events that the market expects to happen in the future. In sum, at any given time in an efficient market, the price of a security will match that security’s intrinsic value. If markets are efficient, then no market participant should be able to consistently earn excess returns.

Grossman and Stiglitz (1980) argue that prices must offer a return to information acquisition, otherwise information will not be gathered and processed. If information is not gathered and processed, the market cannot be efficient. This is known as the Grossman–Stiglitz paradox. They conclude that in equilibrium, if markets are to be efficient, a return should accrue to information acquisition. A market is inefficient if, after deducting such costs, active investing can earn excess returns. An investor or researcher should consider transaction costs and information acquisition costs when evaluating the efficiency of a market.

Fama (1970) proposes three forms of market efficiency: the weak form, the semi-strong form, and the strong form. Weak-form market efficiency assumes that all past market price and volume data are fully reflected in securities’ prices. Thus, if a market is weak-form efficient, technical analysis will not generate excess returns. Semi-strong-form market efficiency assumes that all publicly available information, past and present, is fully reflected in securities’ prices. Thus, if a market is semi-strong-form efficient, technical and fundamental analyses will not generate excess returns. Strong-form

¹⁸ Quoted in Fox (2009).

¹⁹ See Lamont and Thaler (2003).

market efficiency assumes that all information, public and private, is fully reflected in securities' prices. Thus, if a market is strong-form efficient, even insider information will not generate excess returns.

4.1.2 *Studies in Support of the EMH*

The idea of efficient markets goes back to the turn of the 20th century. In 1900, a French mathematician named Louis Bachelier submitted a PhD dissertation to the Sorbonne titled "The Theory of Speculation" which describes market movements as random. The opening paragraphs show his early insights: "Past, present, and even discounted future events are reflected in market price, but often show no apparent relation to price changes....if the market, in effect, does not predict its fluctuations, it does assess them ... mathematically." Many studies have been conducted that support the EMH. Typically, a study tests either the weak form or semi-strong form of efficiency with respect to a particular market. It is more difficult to test the strong form of efficiency. Extensive support for the weak-form and semi-strong forms of market efficiency has been published.

4.1.2.1 Support for the Weak Form of the EMH Initially, most statistical research of the stock market focused on the weak form of market efficiency and tested whether security prices are serially correlated (i.e., whether trends exist in stock prices) or whether they are random (i.e., whether prices of securities, on any given day, are as likely to go up as they are to go down). A number of studies conclude that the path of securities' prices cannot be predicted based on past prices. For example, Roberts (1959) plots the results of a series of randomly generated numbers to see whether any patterns identified by technical analysts are visible. Roberts notes that it is virtually impossible to tell whether his plots are generated using random numbers or actual stock market data. Roberts writes: "If the stock market behaved like a mechanically imperfect roulette wheel, people would notice the imperfections and, by acting on them, remove them."

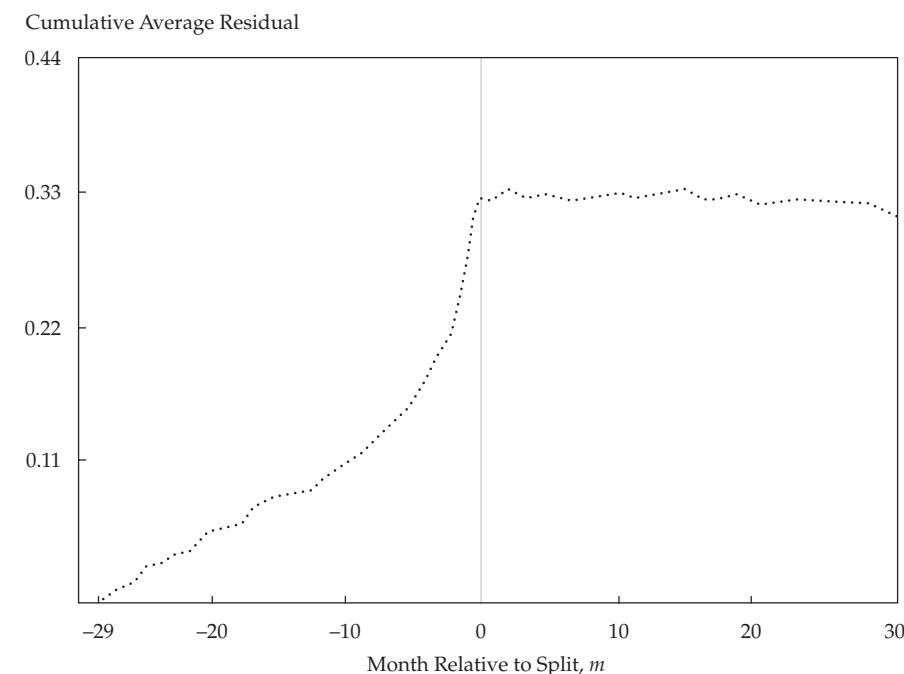
Several other researchers have studied stock price movements. Fama (1965) concludes that daily changes in stock prices had nearly zero positive correlation. He proposes that the stock market works in a way that allows all information contained in past prices to be incorporated into the current price. In other words, markets efficiently process the information contained in past prices. Samuelson (1965) emphasizes the randomness of stock prices. Like Roberts, he finds that market prices follow random patterns and that future stock prices are unpredictable. Samuelson begins with the observation that "in competitive markets there is a buyer for every seller. If one could be sure that a price would rise, it would have already risen." Samuelson asserts that "we would expect people in the marketplace, in pursuit of avid and intelligent self-interest, to take account of those elements of future events that in a probability sense may be discerned to be casting their shadows before them." By presenting his proof in a general form, Samuelson adds strength to the idea that markets are efficient.

Malkiel (1973) provides credence to the idea of random stock price movements. He performed a test in which he gave students a fictional stock that was initially worth \$50. The closing stock price for that stock was determined by a coin flip. If the result was heads, the price would close a half point higher; if the result was tails, it would close a half point lower. Thus, each time, the price had a fifty-fifty chance of closing higher or lower than the previous day. The results of the coin flips were assembled into a chart and graph form. Malkiel took his results in chart and graph form to a chartist (now known as a technical analyst), whom he defined as a person who "seeks to predict future movements by seeking to interpret past patterns on the assumption that 'history tends to repeat itself.'" The chartist told Malkiel that he needed to buy the stock immediately. When Malkiel told him it was based purely on flipping a coin,

the chartist was very unhappy. Malkiel argues that this indicates that the market and stocks can be just as random as flipping a coin. These studies of random stock price movements support the weak form of the EMH.

4.1.2.2 Support for the Semi-Strong Form of the EMH Several studies attempt to test the semi-strong form of market efficiency. These tests are typically event studies. An event study looks at a sample of similar events that occurred to different companies at different times and determines what effect(s) these events had on the stock price (on average) of each company. For example, Fama et al. (1969) study the stock market reaction to stock splits. The study finds that the market begins to anticipate a stock split more than two years before it actually happens and incorporates the consequences of the split the day it is announced. As may be seen in Exhibit 6, stock prices are shown to rise pre-split. This price action is a matter of some debate because stock splits do not technically add any value to a company. Fama et al. find that 72 percent of firms in their sample announced above-average dividend increases in the year after the split and proposed that stock splits signaled that dividend increases were on the horizon. On average, they find that stocks increased sharply prior to the split, but returns after the split were very stable. These results indicate that the implications of a stock split appear to be reflected in price immediately following the *announcement* of the split and not the event itself. This research supports the semi-strong form of market efficiency, because investors would not earn abnormal returns after the stock split information is publicly available. Numerous subsequent event studies also provide support for the semi-strong form of market efficiency.

Exhibit 6 Stock Split Event Study

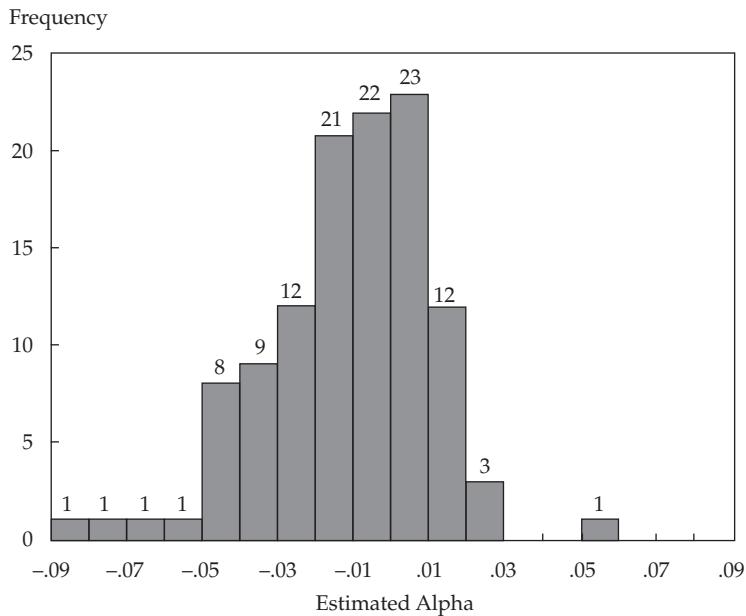


Source: Fama et al. (1969).

Other studies investigate returns to active management. The absence of positive returns to active management is taken as evidence of market efficiency. For example, Alfred Cowles (1933) analyzes thousands of stock selections made by investment professionals from 1928 to 1933 and finds no evidence to suggest that professional

investors are able to outperform the market. Jensen (1967) investigates whether mutual fund managers had the skill to outperform the overall market over the long term. Using fund returns after fees but ignoring sales loads, he examines annual return data for the Standard and Poor's (S&P) 500, which he uses as a proxy for the market portfolio, and 115 mutual funds. He uses regression analysis to determine whether mutual funds in his data set generated positive alphas. His estimated alphas for all 115 mutual funds are summarized in Exhibit 7.

Exhibit 7 Estimated Alphas for 115 Mutual Funds



Source: Jensen (1967).

Jensen finds that the majority have estimated alphas below zero. The average fund's alpha is -0.011 , or -1.1% . This means that after fees, but not including sales loads, the average fund underperforms the overall market by 110 basis points per year during the examination period. Examining the returns gross of fees, the results are marginally better. A majority still have negative alphas, with the average being -0.4% . Studies that demonstrate the ineffectiveness of professional investors, like this one, support the semi-strong form of market efficiency.

4.1.3 Studies Challenging the EMH: Anomalies

Some studies find evidence that appears to contradict market efficiency. These studies mainly describe apparent market anomalies or deviations from the efficient market hypothesis. A market anomaly must persist for a lengthy period to be considered evidence of market inefficiency. Otherwise, the market anomaly may be attributable to the sample period and a strategy that provided abnormal returns in the past may not provide abnormal returns in the future. Exhibit 8 provides a partial list of the studies that claim to identify market anomalies.

Exhibit 8 Selected Research Studies on Market Anomalies

Year	Authors	Article or Study Title	Anomalies Discovered
1968	Ball and Brown	"An Empirical Evaluation of Accounting Income Numbers"	Post earnings announcement drift
1976	Rozeff and Kinney	"Capital Market Seasonality: The Case of Stock Market Returns"	January effect: January stock returns were higher than in any other month
1981	Gibbons and Hess	"Day of the Week Effects and Asset Returns"	Monday effect: Stock prices tended to go down on Mondays
1981	Shiller	"Do Stock Prices Move Too Much to Be Justified by Subsequent Changes in Dividends?"	Excess volatility
1982	Rendleman, Jr., Jones, and Latane	"Empirical Anomalies Based on Unexpected Earnings and the Importance of Risk Adjustments"	Earnings surprises and their effect on the stock price
1985	De Bondt and Thaler	"Does the Stock Market Overreact?"	Stock market overreacts to bad news
1991	Ritter	"The Long-Run Performance of Initial Public Offerings"	Negative long-run performance of IPOs
1992	Fama and French	"The Cross-Section of Expected Stock Returns"	Value investing
1993	Jegadeesh and Titman	"Returns to Buying Winners and Selling Losers; Implications for Stock Market Efficiency"	Momentum

There are three main types of identified market anomalies: fundamental, technical, and calendar. There is, however, disagreement about whether these are actual anomalies or the result of incomplete models being used in the testing. In effect, the test is often a joint test of market efficiency and the pricing model being used to test for it. We will now review some of the primary anomalies in each category.

4.1.3.1 Fundamental Anomalies A fundamental anomaly is an irregularity that emerges when one considers a stock's future performance based on a fundamental assessment of the stock's value. Examples of fundamental anomalies are the performance of small-capitalization companies and value companies compared to large-capitalization companies and growth companies, respectively. The effect of company size on performance has been documented in a number of studies.²⁰

Value and growth investing inherently assume that anomalies from the efficient market hypothesis exist. Value investors attempt to identify stocks that are priced below their intrinsic values in order to earn excess returns. Growth investors attempt to identify stocks with high growth opportunities, which are not yet reflected in current market prices, in order to earn excess returns. Value companies typically have, on a per share basis, lower than average price-to-earnings, price-to-book value, and price-to-sales ratios and higher than average dividend yields. Growth companies typically have, on a per share basis, higher than average price-to-earnings, price-to-book value, and price-to-sales ratios and lower than average dividend yields. A large body of evidence supports the premise that investors consistently overestimate the prospects of growth companies and underestimate the prospects of value companies. As a result, value stocks appear to generate anomalously high returns compared to growth stocks.

²⁰ For example, Banz (1981) and Fama and French (1992).

Numerous studies show that low price-to-book value ratios (high book value to price ratios) are reasonably consistent predictors of future value.²¹ A low price-to-earnings ratio (P/E) is another attribute that tends to correlate anomalously with outperformance. Several studies show that low P/E stocks outperform both high P/E stocks and the market in general.²² Securities with low price-to-sales ratios also appear to exhibit fundamentally anomalous performance. O'Shaughnessy (1996) demonstrates that stocks with low price-to-sales ratios outperform stocks with high price-to-sales ratios as well as stocks in general. He believes that the price-to-sales ratio is the strongest single determinant of excess return. These studies appear to support the existence of a market anomaly.

However, other studies, including Fama and French (1995, 2008), contend that the studies on value investing do not identify anomalies but rather are a function of incomplete models of asset pricing. Fama and French, for example, propose a three-factor model as a more complete model than the capital asset pricing model (CAPM) to predict stock returns. The proposed model includes a market risk premium as in the CAPM, size of the firm based on equity market value, and the ratio of the firm's book value of equity to market value of equity. The latter two factors proxy for sensitivity to risk, and thus their inclusion is consistent with the rational pricing of stocks. The apparent size and value stock anomalies may be a function of incomplete models being used in testing for inefficiency rather than actual anomalies.

4.1.3.2 Technical Anomalies A technical anomaly is an irregularity that emerges when one considers past prices and volume levels. Technical analysis encompasses a number of techniques that attempt to forecast securities prices by studying past prices and volume levels. Common technical analysis strategies are based on relative strength and moving averages, as well as on support and resistance. For example, Brock, Lakonishok, and LeBaron (1992) analyze moving averages and trading range breaks on the Dow Jones Industrial Index from 1897 to 1985. The technical rules addressed in the study are:

- *Moving Averages.* Buy and sell signals are generated by the crossing of a short moving average with a long moving average. When the short moving average moves above (below) the long moving average, the signal is to buy (sell). They test long moving averages of 50, 150, and 200 days with short moving averages of 1, 2, and 5 days.
- *Trading Range Break (Support and Resistance).* A buy signal is generated when the price penetrates the resistance level, and a sell signal is generated when the price penetrates the support level. Brock et al. test support and resistance based on past 50, 150, and 200 days with signals generated when a maximum or minimum is violated by 1 percent. They then compute 10-day holding period returns following the buy and sell signals.

The authors conclude that the “results are consistent with technical rules having predictive power.” However, they warn that transaction costs may reduce the benefits of trading based on technical anomalies. Numerous other researchers dispute the validity of technical analysis. These researchers believe that prices adjust rapidly to new stock market information and that technical analysis is unlikely to provide any advantage to investors who use it. However, proponents of technical analysis continue to argue the validity of certain technical strategies.

²¹ For example, Stattman (1980); Rosenberg, Reid, and Lanstein (1985); Chan, Hamao, and Lakonishok (1991); Fama and French (1992); and Lakonishok, Shleifer, and Vishny (1994).

²² See Ball (1978); Basu (1983); Jaffe, Keim, and Westerfield (1989); Chan, Hamao, and Lakonishok (1991); and Fama and French (1992).

4.1.3.3 Calendar Anomalies A calendar anomaly is an irregularity identified when patterns of trading behavior that occur at certain times of the year are considered. A well known calendar anomaly is the January effect. Historically, stocks in general—and small stocks, in particular—have delivered abnormally high returns during the month of January. Haugen and Jorion, two researchers on the subject, note that “The January Effect is, perhaps, the best known example of anomalous behavior in security markets throughout the world.”²³ The January effect is particularly interesting because it has not disappeared despite being well known for 25 years. Arbitrage theory tells us that anomalies should disappear as traders attempt to exploit them in advance.

Some studies have shown that stocks earn higher returns on the last day and first four days of each month—the turn-of-the-month effect. Hensel and Ziembra (1996) examined returns of the S&P 500 over a 65-year period and found that US large-cap stocks consistently generate higher returns at the turn of the month. In fact, they found “that the total return from the S&P 500 over this sixty-five-year period was received mostly during the turn of the month.” The study implies that investors making regular stock purchases may benefit by scheduling those purchases prior to the turn of the month.

4.1.3.4 Anomalies: Conclusion Support exists for both efficient markets and anomalous markets. Studies that claim to identify anomalies are often critiqued for their use of an assumed pricing model. When an assumed pricing model is used, it is impossible to say if the observed results are indicative of a true anomaly or simply a consequence of using an incorrect pricing model. In reality, markets are neither perfectly efficient nor completely anomalous; market efficiency is not black or white, but rather gray. In markets exhibiting substantial inefficiency, sophisticated investors may be able to outperform less savvy participants. Many analysts believe that such US large-capitalization stocks as GE and Microsoft are quite efficient, but US small-capitalization and international stocks offer more opportunities for outperformance. Alternative investment markets, such as real estate and venture capital markets, may be less efficient. They lack fluid and continuous prices, and information asymmetries may exist between market participants. This may restrict arbitrage from pricing away market inefficiencies.

4.1.3.5 Limits to Arbitrage Shleifer and Vishny (1997) develop a theory of limited arbitrage. They assume that implicit restrictions are placed on a fund’s ability to arbitrage by investors’ ability to withdraw their money. The potential for withdrawal of money imposes limits on the ability of the fund to take advantage of arbitrage situations in which two securities are not rationally priced (priced at intrinsic or fundamental value based on all available information), because securities’ prices may remain in a non-equilibrium (irrational) state for long periods of time. In other words, when a firm or portfolio manager is viewed as incompetent or simply wrong about a trade, because certain securities remain irrationally priced for extended periods of time, investors may withdraw their money before the irrational pricing corrects itself and the position may have to be closed prematurely. In his 2010 book “The Big Short,” Michael Lewis describes the situation where a hedge fund manager, Michael Burry, was criticized for years by his investors and backers for holding credit default swaps on sub-prime mortgages (effectively shorting the sub-prime housing market) only to have the investment pay off handsomely in the end. His ability to impose restrictions on withdrawal of money from his fund was the only reason he was able to make his investment strategy pay off.

Shleifer and Vishny’s theory of limited arbitrage is in stark contrast to the EMH, which assumes that whenever mispricing of a publicly traded stock occurs, an opportunity for arbitrage profit is created for rational traders who should act on those opportunities, resulting in rational pricing (efficient markets). Why might rational traders

²³ Haugen and Jorion (1996).

choose not to act on observed opportunities? If market participants are engaged in highly leveraged arbitrage trades and prices move against them and stay there for an extended time before returning to intrinsic value, they may eventually need to liquidate prior to realizing the gains expected to result from the prices moving to intrinsic value. In the professional money management business, clients may demand liquidity before a manager's strategy is fully implemented and a successful outcome is realized. To deliver funds, the manager may have to sell or close out positions at a loss. The possibility of an extended period of mispricing and the potential need for liquidity makes market participants less prone to take advantage of arbitrage opportunities. This action has the tendency to exacerbate the problem of pricing inefficiency.

Implicit in the limits to the arbitrage idea is that the EMH does not hold. Specifically, if market participants are engaged in highly leveraged arbitrage trades and prices move against them and stay there irrationally before returning to fundamental value, they may eventually need to liquidate prior to realizing the gains expected to result from the prices moving to fundamental value. Rational traders often work for professional asset management firms and invest other peoples' money. If they engage in arbitrage in reaction to a stock mispricing and the mispricing persists for an extended period, clients of the money management firm can (and do) withdraw their funds. The clients are not willing to wait for the manager's expectations to be met. To deliver funds, the manager must unwind positions at a loss. This is a reason for the restrictions placed on hedge fund withdrawals (i.e., lock-up periods).

4.2 Traditional Perspectives on Portfolio Construction

From a traditional finance perspective, a "rational" portfolio is one that is mean–variance efficient. The appropriate portfolio for an investor is constructed holistically by considering the investor's tolerance for risk, investment objectives, investment constraints, and investor circumstances. An investor will typically take or administer a risk tolerance questionnaire, document financial goals and constraints, and then adopt the output of a mean–variance model (optimized using software or human judgment) that matches the investor's risk tolerance category and accomplishes the investor's financial goals. In the case of institutional investors, they will consider these items from the perspective of the entity they are acting on behalf of. An investment adviser will consider these items from the perspective of the client when developing investment policy statements and asset allocations. Subject to investment objectives and constraints, a suitable portfolio is chosen from the opportunity set of mean–variance efficient portfolios. The output of the mean–variance model may be considered as a "rational" or optimal portfolio allocation.

However, this approach to portfolio construction implicitly assumes that investors (or their advisers) have perfect information and that investors behave rationally in forming their portfolios. If these assumptions do not apply, then portfolios may be constructed using other approaches resulting in portfolios that have too much or too little risk when compared to the optimal portfolio. Further, although a portfolio based on mean–variance optimization may be theoretically sound, it may fail to meet the needs of the investor because of behavioral considerations.

4.3 Alternative Models of Market Behavior and Portfolio Construction

The traditional finance perspective of market behavior may not satisfactorily explain observed market behavior and portfolio construction, but a significant challenge also exists for behavioral finance. There is no single unifying theory of behavioral finance to explain the observed market behaviors. In the absence of such a theory, supporters

of traditional finance perspectives contend that the traditional finance perspectives remain superior to behavioral finance perspectives. A number of behavioral models have been advanced, but none has yet been accepted as presenting a complete or unifying description of market behavior. Four of the behavioral models advanced to explain market behavior and portfolio construction are discussed in the following sections. None of these models has yet achieved the kind of general acceptance among finance practitioners and academics that the EMH and mean–variance portfolio construction models have.

4.3.1 A Behavioral Approach to Consumption and Savings

Shefrin and Thaler (1988) propose an alternative to the traditional life-cycle model in which people are assumed to spend and save money rationally to achieve an optimal short-term and long-term consumption plan. They developed a behavioral life-cycle theory that incorporates self-control, mental accounting, and framing biases. In the traditional life-cycle model, self-control allows people to pursue long-term goals rather than focus on short-term satisfaction. In behavioral finance, the self-control bias recognizes that people may focus on short-term satisfaction to the detriment of long-term goals. Mental accounting is the phenomenon whereby people treat one sum of money differently from another sum of money even though money is fungible (interchangeable). Framing bias results in different responses based on how questions are asked (framed).

Shefrin and Thaler suggest that people classify their sources of wealth into three basic accounts: current income, currently owned assets, and the present value of future income. This mental accounting exists even though money is fungible. Mental accounting is a partial response to the issue of self-control. By classifying some wealth so that it is considered less available, it is less likely to be consumed in the short-term. People are assumed to be most likely to spend from current income (high marginal propensity to consume) and least likely to spend based on expectations of future income (low marginal propensity to consume). In other words, people lack self-control when it comes to current income. Any current income that is saved is reclassified as current assets or future income. The portion saved will increase with income. As Shefrin and Thaler indicated, “To the poor, saving is a luxury.” Mental accounting and framing help people accommodate the competing goals of short-term gratification and long-term benefits. Rather than viewing money (their wealth) as fungible, people tend to frame their expenditure decisions taking into account the source of the wealth.

Individuals are hypothesized to first spend current income, then to spend based on current assets, and finally to spend based on future income. These propensities to consume have a variety of implications. For example, people may save a higher proportion of bonus income because they may classify bonus income as a current asset rather than current income and thus have a lower marginal propensity to consume it. If a government cuts taxes but does not reduce withholding rates, the ensuing tax refunds may be treated as current assets rather than current income. This may result in greater savings than if the tax reduction had been treated as current income. When spending from current assets, liquidity and maturity are taken into account. Basically, such short-term liquid assets as cash and checking accounts are liquidated first to finance current expenditures. Long-term, less-liquid assets, such as homes and retirement savings, are less likely to be used to finance current expenditures. However, individuals who view home equity as part of current assets are more likely to take out loans based on their home's value to finance current consumption than individuals who view their home as part of their retirement assets or future income. Similarly, individuals who classify pension assets as current assets rather than as a source of future retirement income are more prone to take loans against or spend their pension assets.

Shefrin and Thaler hypothesize that individuals will spend, for current consumption, most of their current income, varying portions of their currently owned assets, and very little based on their expectations of future income. The consumption/saving (investment) decisions made when individuals are subject to self-control, mental accounting, and framing biases differ from those of the rational economic individuals of traditional finance. Although mental accounting and framing will result in some saving for long-term goals, the outcome will not necessarily match the optimal short-term and long-term consumption plan of traditional life-cycle models. As a result, individuals will not achieve their theoretically optimal short-term and long-term consumption opportunities. Knowledge of behavioral propensities may help people move closer to the optimal solutions of traditional finance.

4.3.2 A Behavioral Approach to Asset Pricing

Some researchers believe that market behaviors are better explained from a behavioral perspective than a traditional perspective, which assumes that perfectly rational investors make wealth-maximizing decisions at all times using all available information. They find the traditional perspective difficult to accept because they observe investors displaying biased behaviors that lead to less-than-optimal decisions.

Shefrin and Statman (1994) begin to develop an alternative to the classic capital asset pricing model. Shefrin (2005, 2008) develops the idea further and proposes a behavioral approach to asset pricing using models, which Shefrin terms behavioral stochastic discount factor-based (SDF-based) asset pricing models. Shefrin, based on the results of empirical tests, concludes that investors do not make their decisions in an unbiased way. The stochastic discount factor to reflect this bias is a function of investor sentiment relative to fundamental value. The model focuses on market sentiment as a major determinant of asset pricing, which in turn is derived from systematic errors in judgment committed by investors. Shefrin asserts that sentiment causes asset prices to deviate from values determined using traditional finance approaches.

In order to have a tractable behavioral approach to asset pricing, it is necessary to have a well-defined measure of sentiment with an impact that can be traced on market prices and risk premiums. Shefrin (2005) proposes that the dispersion of analysts' forecasts serves as a proxy for the sentiment risk premium in the model. In support of this theory, he cites Ghysels and Juergens (2004), who determine that dispersion of analysts' forecasts is statistically significant in a Fama–French multi-risk-factor framework. Alternatively, the dispersion of analysts' forecasts may be a systematic risk factor not accounted for by other factors in the model. Doukas, Kim, and Pantzalis (2004) find that value stocks earn higher returns than growth stocks because the dispersion of analysts' forecasts is greater for value stocks—which supports dispersion of opinion as a measure for a source of risk.

Shefrin develops a stochastic process for sentiment and a fundamental SDF-based asset-pricing equation. The price of an asset is the expected value of its discounted payoffs. The discount rate captures the effects of the time value of money, fundamental risk, and sentiment risk. Sentiment pertains to erroneous, subjectively determined beliefs. If an investor's subjective beliefs about the discount rate match those of traditional finance, the investor is said to have zero risk sentiment. If an investor's subjective beliefs about the discount rate do not match those of traditional finance, the investor's beliefs are said to include risk sentiment. Thus, the discount rate on a security is the sum of the risk-free rate and fundamental premiums (corresponding to efficient prices) and a sentiment premium (reflecting sentiment-based risk).²⁴

²⁴ See Shefrin (2008).

Although Shefrin cites evidence that investors commit errors that result in inefficient prices in the aggregate, it is important to determine if these errors are either systematic or essentially random in nature. If they are systematic, then the errors may be predicted and exploited to earn excess returns. A logical assumption, in that case, is that rational and informed investors—however few in number—would act on these inefficiencies and thereby limit the scope of the pricing errors. If investors' errors are random in nature, however, then observing and modeling them presents a formidable challenge, as indicated in the original work by Shefrin and Statman (1994).

4.3.3 Behavioral Portfolio Theory

Shefrin and Statman (2000) extend their 1994 work to develop behavioral portfolio theory (BPT). BPT uses a probability-weighting function rather than the real probability distribution used in Markowitz's portfolio theory (1952). The optimal portfolio under BPT can differ from the perfectly diversified portfolio of Markowitz. In Markowitz's portfolio theory, risk-averse investors construct diversified portfolios based on mean–variance analysis and consideration of the covariance between assets. They are concerned about the expected return and variance of the portfolio as a whole. In behavioral portfolio theory, however, investors construct their portfolios in layers and expectations of returns and attitudes toward risk vary between the layers. The resulting portfolio may appear well-diversified, but diversification is incidental to and not necessarily an objective of the portfolio construction.

Shefrin and Statman contend that portfolio construction is primarily a function of five factors. First, the allocation to different layers depends on investor goals and the importance assigned to each goal. For example, if high importance is assigned to an upside potential goal, then the allocation of funds to the layer with the highest upside potential will be greater than if high importance is attached to minimizing potential downside losses. Second, the allocation of funds within a layer to specific assets will depend on the goal set for the layer. If a higher goal is set, then the assets selected for the layer are likely to be riskier or more speculative in nature. Third, the number of assets chosen for a layer depends on the shape of the investor's utility function. Risk-averse individuals have concave utility functions, meaning that utility increases at a decreasing rate with increases in wealth (diminishing marginal utility of wealth). The greater the concavity of the utility curve, the earlier the satiation for a specific security. Thus, the greater the concavity of the utility curve, the greater the number of securities included in a layer. Fourth, concentrated positions in some securities may occur if investors believe they have an informational advantage with respect to the securities. Fifth, investors reluctant to realize losses may hold higher amounts of cash so that they do not have to meet liquidity needs by selling assets that may be in a loss position. Further, the portfolios of investors reluctant to realize losses may continue to hold some securities not because of the securities' potential, but rather because of the investor's aversion to realize losses. Although the resulting portfolios may appear well-diversified, they may not, in fact, be well-diversified from a mean–variance perspective. In other words, the portfolio may not be mean–variance efficient.

Shefrin and Statman explain how BPT is consistent with the apparently irrational behavioral tendency of many people to purchase insurance policies and also buy lottery tickets, as discussed in Friedman and Savage (1948). A BPT investor maximizes expected wealth subject to the constraint that the probability of the wealth being less than some aspirational level cannot exceed some specified probability. A BPT investor can tolerate failure to achieve at least the aspirational level of wealth but only with a small probability. In other words, the investor maximizes expected wealth on a particular portfolio subject to a safety constraint. As a result, the optimal portfolio of a BPT investor is a combination of bonds or riskless assets and highly speculative assets. The BPT investor is essentially constructing a portfolio equivalent to an insurance policy and a lottery ticket.

In the first layer, the investor seeks safety by buying bonds or riskless assets in order to insure his aspirational level of wealth with a small maximum chance of failure. In the second layer, the investor is willing to take risk with the residual wealth. In consequence, a BPT-optimal portfolio can differ from the rational diversified portfolio that is mean-variance efficient. In the BPT model, risk aversion is taken into account by the constraint that limits the risk of failing to achieve the aspirational level of wealth.

EXAMPLE 3

Behavioral Portfolio Theory

Two BPT investors are developing portfolios. The portfolios will contain at most three layers: a layer of riskless investments, a layer of moderately risky investments, and a layer of highly risky speculative investments. The riskless investments (layer 1) are expected to return 1 percent; the moderately risky investments (layer 2) are expected to return -3 percent with 10 percent probability, 5 percent with 80 percent probability, and 9 percent with 10 percent probability; and the speculative investments (layer 3) are expected to return -50 percent with 15 percent probability, 12 percent with 50 percent probability, and 75 percent with 35 percent probability.

The first BPT investor has 2,000,000 euros and an aspirational level of 2,000,000 euros with a probability of 100 percent. In other words, this BPT investor will not tolerate any loss in wealth. The second BPT investor has 2,000,000 euros and an aspirational level of 2,100,000 euros with a probability of 80 percent. Further, this investor can tolerate some potential loss in wealth but cannot tolerate the portfolio declining below 1,800,000 euros. Construct the optimal portfolio for the first BPT investor. In addition, evaluate whether the second BPT investor's portfolio is optimal if the investor puts 1,568,627 euros in layer 1 and 431,373 euros in layer 3.

Solution:

The first BPT investor's portfolio will be approximately 100 percent in the layer of riskless investments given the inability to tolerate any losses. The second BPT investor has an aspirational level of return of 5 percent (100,000 euros). Given the safety level and a maximum potential loss of 50 percent on the speculative assets, the investor may put approximately 1,568,627 euros in layer 1 and 431,373 euros in layer 3. This portfolio will result in an expected return of 6.123 percent.

	Allocation	Expected Return	Portfolio Return
Layer 1	78.43%	1.00%	0.784%
Layer 2	0.00%	4.60%	0.000%
Layer 3	21.57%	24.75%	5.339%
Total	100.00%		6.123%

This portfolio will result in 1,800,000 euros with 15 percent probability, 2,067,451 euros with 50 percent probability, and 2,339,216 euros with 35 percent probability. The safety objective is met, but the portfolio is short of the aspirational goal. The portfolio will result in at least 2,067,451 euros with 85 percent

probability rather than 2,100,000 euros with 80 percent probability. Based on risk tolerance, the investor may decide this is acceptable or may decide to lower her safety level objective.

(Note: The resulting portfolios are not necessarily mean–variance efficient because no consideration is given to the covariance of the investment layers.)

4.3.4 Adaptive Markets Hypothesis

Lo (2004) proposes the **adaptive markets hypothesis** (AMH). The AMH applies principles of evolution—such as competition, adaptation, and natural selection—to financial markets in an attempt to reconcile efficient market theories with behavioral alternatives. Similar to factors that influence an ecological system, markets are influenced by competition for scarce resources and the adaptability of participants. The greater the competition for scarce resources or in markets for profits and the less adaptable the participants, the greater the likelihood of not surviving. Following are two examples that have been simplified but serve to demonstrate the ideas behind the AMH. In a natural example, pandas are extremely non-adaptable, eating only bamboo. This reduces the likelihood of pandas surviving in significant numbers outside of protected settings. In a financial example, Long-Term Capital Management (LTCM) was faced with increasing competition that used the same arbitrage techniques as LTCM did. Rather than adapting and changing techniques, LTCM increased leverage and ultimately faced the possibility of non-survival.

Lo notes that biases identified by those researching in behavioral finance may be consistent with the AMH. These biases are simply the result of applying previously learned heuristics to a changed environment where they no longer work. The successful participant will adapt to the changed environment and develop new heuristics. Success is defined as survival rather than as having maximized expected utility.

Behavior of market participants is not necessarily that of a REM, but is rather behavior that is perceived to result in less-than-optimal rational outcomes. Lo discusses this in the context of Simon's notions of bounded rationality and satisficing.²⁵ As a result of informational, intellectual, and computational limitations, individuals use judgment to gather sufficient information, to adequately process the information, to identify with satisfactory sub-goals and limited objectives rather than try to achieve an optimum, and to make decisions that meet these sub-goals and objectives. Applying an evolutionary perspective to Simon's framework provides useful insights. For example, the choice of satisfactory goals is determined through trial and error, which can be viewed as equivalent to a process of natural selection. As experience increases, individuals learn and the heuristics they apply to a situation evolve. As these heuristics based on past experiences are applied to new situations, they may or may not be appropriate and additional learning takes place.

The AMH is a revised version of the EMH that considers bounded rationality, satisficing, and evolutionary principles. Under the AMH, individuals act in their own self-interest, make mistakes, and learn and adapt; competition motivates adaptation and innovation; and natural selection and evolution determine market dynamics. Five implications of the AMH are: 1) The relationship between risk and reward varies over time (risk premiums change over time) because of changes in risk preferences and such other factors as changes in the competitive environment; 2) active management can add value by exploiting arbitrage opportunities; 3) any particular investment strategy will not consistently do well but will have periods of superior and inferior performance; 4)

²⁵ See Simon (1957).

the ability to adapt and innovate is critical for survival; and 5) survival is the essential objective. In other words, recognizing that things change, the survivors will be those who successfully learn and adapt to changes.

SUMMARY

With its simplifying assumption of rational investors and efficient markets, traditional finance has gained wide acceptance among academics and investment professionals as a guide to financial decision making. Over time, however, the limitations of traditional finance have become increasingly apparent. Individual decision making is not nearly as objective and intellectually rigorous, and financial markets are not always as rational and efficiently priced as traditional finance assumes. To bridge this gap between theory and practice, behavioral finance approaches decision making from an empirical perspective. It identifies patterns of individual behavior without trying to justify or rationalize them.

A practical integration of behavioral and traditional finance may lead to a better outcome than either approach used in isolation. By knowing how investors should behave and how investors are likely to behave, it may be possible to construct investment solutions that are both more rational from a traditional perspective and, because of adjustments reflecting behavioral insights, easier to accept and remain committed to. Although these behavioral insights will not lead easily or automatically to superior results, it is hoped that they will help many improve their investment approach and enhance risk management.

Among the points made in this reading are the following:

- Traditional finance assumes that investors are rational: Investors are risk-averse, self-interested utility-maximizers who process available information in an unbiased way.
- Traditional finance assumes that investors construct and hold optimal portfolios; optimal portfolios are mean-variance efficient.
- Traditional finance hypothesizes that markets are efficient: Market prices incorporate and reflect all available and relevant information.
- Behavioral finance makes different (non-normative) assumptions about investor and market behaviors.
- Behavioral finance attempts to understand and explain observed investor and market behaviors; observed behaviors often differ from the idealized behaviors assumed under traditional finance.
- Behavioral biases are observed to affect the financial decisions of individuals.
- Bounded rationality is proposed as an alternative to assuming perfect information and perfect rationality on the part of individuals: Individuals are acknowledged to have informational, intellectual, and computational limitations and as a result may satisfice rather than optimize when making decisions.
- Prospect theory is proposed as an alternative to expected utility theory. Within prospect theory, loss aversion is proposed as an alternative to risk aversion.
- Markets are not always observed to be efficient; anomalous markets are observed.
- Theories and models based on behavioral perspectives have been advanced to explain observed market behavior and portfolio construction.

- One behavioral approach to asset pricing suggests that the discount rate used to value an asset should include a sentiment risk premium.
- Behavioral portfolio theory suggests that portfolios are constructed in layers to satisfy investor goals rather than to be mean-variance efficient.
- The behavioral life-cycle hypothesis suggests that people classify their assets into non-fungible mental accounts and develop spending (current consumption) and savings (future consumption) plans that, although not optimal, achieve some balance between short-term gratification and long-term goals.
- The adaptive markets hypothesis, based on some principles of evolutionary biology, suggests that the degree of market efficiency is related to environmental factors characterizing market ecology. These factors include the number of competitors in the market, the magnitude of profit opportunities available, and the adaptability of the market participants.
- By understanding investor behavior, it may be possible to construct investment solutions that will be closer to the rational solution of traditional finance and, because of adjustments reflecting behavioral insights, easier to accept and remain committed to.

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PRACTICE PROBLEMS

The following information relates to Questions 1–6

Mimi Fong, CFA, a private wealth manager with an asset management firm, has been asked to make a presentation to her colleagues comparing traditional and behavioral finance. She decides to enliven her presentation with statements from colleagues and clients. These statements are intended to demonstrate some key aspects of and differences between traditional and behavioral finance.

- Statement 1 (from a colleague): “When new information on a company becomes available, I adjust my expectations for that company’s stock based on past experiences with similar information.”
- Statement 2 (from a client): “When considering investments, I have always liked using long option positions. I like their risk/return tradeoffs. My personal estimates of the probability of gains seem to be higher than that implied by the market prices. I am not sure how to explain that, but to me long options provide tremendous upside potential with little risk, given the low probability of limited losses.”
- Statement 3 (from a client): “I have always followed a budget and have been a disciplined saver for decades. Even in hard times when I had to reduce my usual discretionary spending, I always managed to save.”
- Statement 4 (from a colleague): “While I try to make decisions analytically, I do believe the markets can be driven by the emotions of others. So I have frequently used buy/sell signals when investing. Also, my 20 years of experience with managers who actively trade on such information makes me think they are worth the fees they charge.”
- Statement 5 (from a colleague): “Most of my clients need a well-informed advisor to analyze investment choices and to educate them on their opportunities. They prefer to be presented with three to six viable strategies to achieve their goals. They like to be able to match their goals with specific investment allocations or layers of their portfolio.”
- Statement 6 (from a client): “I follow a disciplined approach to investing. When a stock has appreciated by 15 percent, I sell it. Also, I sell a stock when its price has declined by 25 percent from my initial purchase price.”
- Statement 7 (from a client): “Overall, I have always been willing to take a small chance of losing up to 8 percent of the portfolio annually. I can accept any asset classes to meet my financial goals if this

constraint is considered. In other words, an acceptable portfolio will satisfy the following condition: $\text{Expected return} - 1.645 \times \text{Expected standard deviation} \geq -8\%$."

- 1 Which of the following statements is *most* consistent with expected utility theory?
 - A Statement 1.
 - B Statement 2.
 - C Statement 3.
 - 2 Which of the following statements *most likely* indicates a belief that technical anomalies exist in the capital markets?
 - A Statement 2.
 - B Statement 4.
 - C Statement 6.
 - 3 Statement 4 is *most* consistent with:
 - A the adaptive markets hypothesis.
 - B a behavioral approach to asset pricing.
 - C Savage's subjective expected utility theory.
 - 4 The clients of Statement 5 *most likely* exhibit:
 - A loss-aversion.
 - B bounded rationality.
 - C mental accounting bias.
 - 5 The client of Statement 6 is *most likely* behaving consistently with:
 - A prospect theory.
 - B expected utility theory.
 - C behavioral portfolio theory.
 - 6 The client of Statement 7 would *most likely* agree with which of the following statements?
 - A I strive for a mean–variance efficient portfolio.
 - B I construct my portfolio in layers to meet my goals.
 - C I am loss-averse and have a value function that is steeper for losses than gains.
-

The following information relates to Questions 7–10

Professor Mehul Liu teaches several behavioral finance courses at a local university. In his current lecture, he discusses how behavioral finance differs from traditional finance.

Liu discusses how loss-averse investors assess risk and return. Liu then presents two investment choices to the students:

Exhibit 1

Investment	Expected Return	Expected Range of Returns
A	6%	0% to 11%
B	12%	-10% to 20%

- 7 **Determine** the investment in Exhibit 1 that a loss-averse investor would *most likely* prefer. **Justify** your response.

Determine the investment in Exhibit 1 that a loss-averse investor would *most likely* prefer.
(circle one) **Justify your response.**

Investment A

Investment B

The topic of another lecture is prospect theory. Liu presents the students with the following two situations and asks them if they would accept or reject each one:

Situation 1 A 50% probability of winning \$10,000 and a 50% probability of losing \$4,000

Situation 2 A 50% probability of winning \$10,000 and a 50% probability of losing \$8,000

The students vote to accept Situation 1 but reject Situation 2. Liu then presents a third situation:

Situation 3 Choosing between losing \$12,000 with 100% certainty, or accepting a gamble that offers a 50% probability of winning \$6,000 and a 50% probability of losing \$24,000

The students vote to accept the gamble in Situation 3.

- 8 **Explain** how the voting results in *each* of the three situations are consistent with prospect theory.

- i. Accepting Situation 1
- ii. Rejecting Situation 2
- iii. Accepting the gamble in Situation 3

A student meets with Liu after one of his lectures. The student is participating in a mock investment competition that requires participants to create and manage a fictitious equity portfolio. Even though international equities are available as an investable asset class, the student elects to invest her entire portfolio in domestic equities.

Liu asks the student if she has ever considered including international equities in her competition portfolio given their diversification benefits and higher expected returns than domestic equities based on current consensus growth forecasts. The student responds that she has not considered international equities because she

has not taken any courses in international investments that could provide her with expertise in this area. The student also indicates that she has the time and resources to research only domestic companies.

- 9 Determine** whether bounded rationality has affected the student's investment decision-making process. **Justify** your response.

Liu presents the following hypothetical scenario during a lecture on behavioral portfolio theory (BPT).

Ann Lundstrom, a fictitious technology entrepreneur, is a BPT investor who is developing her portfolio. This portfolio will contain two layers: a layer of riskless investments and a layer of speculative investments. The riskless layer will earn 0.50%, and the probability distribution of the expected return on the speculative layer is shown in Exhibit 2.

Exhibit 2 Speculative Investment Layer Return/Probability

Expected Return	Probability
-25%	10%
12%	60%
50%	30%

Lundstrom plans to invest \$1,000,000 and has an aspirational level of \$1,050,000 with a probability of 75%. She can tolerate some potential loss in wealth but not more than \$100,000 (minimum portfolio value of \$900,000). Exhibit 3 presents two potential portfolio allocations for this scenario.

Exhibit 3 Portfolio Allocations

Layer	Allocation 1	Allocation 2
Riskless	59%	90%
Speculative	41%	10%

- 10 Determine** which portfolio allocation in Exhibit 3 is *closest* to the BPT optimal portfolio for Lundstrom. **Justify** your response.

Determine which portfolio allocation in Exhibit 3 is closest to the BPT optimal portfolio for Lundstrom. (circle one).

Allocation 1

Allocation 2

Justify your response.

SOLUTIONS

- 1 C is correct. Statement 3 is most consistent with expected utility theory. The client exhibits self-control and is able to defer consumption. This client is considering short-term and long-term goals and attempting to maximize the present value of utility. In Statement 1, beliefs are being updated using heuristics rather than Bayes' formula. Statement 2 is consistent with prospect theory; the client is overweighting the probability of a high financial impact outcome (gains on options) and underweighting the probability of a loss (the option premium cost).
- 2 B is correct. Statement 4 indicates the belief that buy/sell signals can be used to earn excess returns.
- 3 B is correct. Statement 4 indicates that markets can be influenced by the emotions of others (sentiment). This is consistent with a behavioral approach to asset pricing that includes sentiment such as the behavioral stochastic discount factor-based asset pricing model proposed by Shefrin.
- 4 C is correct. The clients discussed in Statement 5 exhibit mental accounting bias because they consider their portfolio by matching its layers to goals. The clients may not have time themselves to examine the investment universe and arrive at optimal solutions, but they rely on their adviser to do this for them. Thus, they do not exhibit bounded rationality.
- 5 C is correct. The client of Statement 6 is behaving consistently with behavioral portfolio theory. The client sells and holds a stock not because of the stock's potential, but rather from a fear of the stock declining in value and gains dissipating and an aversion to realizing losses. Loss-aversion in prospect theory is discussed from a different perspective.
- 6 A is correct. The client is expressing a portfolio goal that considers expected return and standard deviation. This is consistent with traditional finance and the client is likely to prefer a mean-variance efficient portfolio. There is nothing in the statement that indicates loss-aversion as opposed to risk-aversion or a preference for constructing a portfolio in layers.

7

Determine the investment in Exhibit 1 that a loss-averse investor would *most likely* prefer.

(circle one)

Justify your response.

Investment A

A loss-averse investor will most likely prefer Investment A

Investment B

and accept a lower expected return to avoid the potential risk of loss presented by Investment B. The loss-averse investor is likely willing to accept a lower expected return to avoid any possibility of incurring a loss.

- 8 Prospect theory is an alternative to expected utility theory. This theory describes how individuals make choices in situations in which they must decide between alternatives that involve risk and how they evaluate potential losses and gains. Prospect theory considers how alternatives are perceived based on their framing, how gains and losses are evaluated, and how uncertain outcomes are weighted.

i. Accepting Situation 1

- Most people reject a gamble with even chances to win and lose unless the possible win is at least twice the size of the possible loss.

In this gamble, the possible win is 2.5 times the possible loss, so the student vote to accept Situation 1 is consistent with prospect theory. Accepting Situation 1 is consistent with prospect theory because experimental evidence shows that most people reject a gamble with even chances to win and lose, unless the possible win is at least twice the size of the possible loss.

ii. Rejecting Situation 2

- Most people reject a gamble with even chances to win and lose unless the possible win is at least twice the size of the possible loss.
- In Situation 2, the chances to win and lose are the same but the possible win is only 1.25 times the possible loss. Thus the student vote to reject Situation 2 is consistent with prospect theory.

Rejecting Situation 2 is consistent with prospect theory because experimental evidence shows that most people reject a gamble with even chances to win and lose, unless the possible win is at least twice the size of the possible loss. In Situation 2, the possible win is only 1.25 times the possible loss, so the student vote to reject the investment is consistent with prospect theory.

iii. Accepting the gamble in Situation 3

- People are risk-seeking when there is a low probability of gains or a high probability of losses.
- Deviations in decision making result in overweighting low-probability outcomes.

The gamble may appear more attractive than the sure loss, so the student vote to accept the gamble is consistent with prospect theory. Experimental evidence shows that risk-seeking preferences are held by a large majority of people when there is a low probability of gains or a high probability of losses. Therefore, the student vote to accept the gamble over the sure loss in Situation 3 is consistent with prospect theory.

9 Guideline answer:

- Bounded rationality describes the phenomenon whereby people gather some (but not all) available information.
- The student does not behave totally rationally because she is not gathering full information to identify international equity investment opportunities.
- Her decision meets the criterion specified of creating and managing a fictitious equity portfolio but is not necessarily optimal.
- Although higher returns may be possible in international equities, investing fully in domestic equities satisfies within the totality of the investor's decision-making environment.

The notion of bounded rationality recognizes that people are not fully rational when making decisions and do not necessarily optimize but rather satisfice when arriving at their decisions. People have informational, intellectual, and computational limitations. Bounded rationality describes the phenomenon whereby people gather some (but not all) available information, use heuristics to make the process of analyzing the information tractable, and stop when they have arrived at a satisfactory, but not necessarily optimal, decision.

The student does not behave totally rationally because she is not gathering full information to identify possible international equity investment opportunities and doesn't have the knowledge to do so. Her behavior is boundedly rational

because her decision meets the criterion specified of creating and managing a fictitious equity portfolio but is not necessarily optimal. Although the decision is suboptimal, because higher returns may be possible in global markets, it satisfies within the totality of the student's decision-making environment. The student may have decided that she lacked the knowledge, time, and resources to research all alternatives. Given the student's apparently limited knowledge of international equities markets, and considering time constraints and the sole criterion of investing in equities, the decision to invest all of her portfolio in US equities may be reasonable.

10

Determine which portfolio allocation in Exhibit 3 is closest to the BPT optimal portfolio for Lundstrom. (circle one).

Allocation 1	Allocation 2
--------------	--------------

Justify your response.

- Both portfolio allocations meet the safety objective of \$900,000.
- Allocation 1 has a 90% chance of exceeding the aspirational level of \$1,050,000, whereas Allocation 2 only has a 30% chance of exceeding it.

A BPT investor constructs a portfolio in layers to satisfy investor goals rather than be mean–variance efficient. The investor's expectations of returns and attitudes toward risk vary between the layers. In this case, Lundstrom has a safety objective of \$900,000 and aspirational level of return of 5% (\$50,000) with a 75% probability.

Given the expected returns for the riskless and speculative layers, Allocation 1 will result in the following amounts:

$$\begin{aligned} \text{10\% chance: } & (59\% \times \$1,000,000) \times 1.005 + (41\% \times \$1,000,000) \times (1 - 0.25) = \\ & \$900,450 \end{aligned}$$

$$\begin{aligned} \text{60\% chance: } & (59\% \times \$1,000,000) \times 1.005 + (41\% \times \$1,000,000) \times (1.12) = \\ & \$1,052,150 \end{aligned}$$

$$\begin{aligned} \text{30\% chance: } & (59\% \times \$1,000,000) \times 1.005 + (41\% \times \$1,000,000) \times (1.50) = \\ & \$1,207,950. \end{aligned}$$

Given the expected returns for the riskless and speculative layers, Allocation 2 will result in the following amounts:

$$\begin{aligned} \text{10\% chance: } & (90\% \times \$1,000,000) \times 1.005 + (10\% \times \$1,000,000) \times (1 - 0.25) = \\ & \$979,500 \end{aligned}$$

$$\begin{aligned} \text{60\% chance: } & (90\% \times \$1,000,000) \times 1.005 + (10\% \times \$1,000,000) \times (1.12) = \\ & \$1,016,500 \end{aligned}$$

$$\begin{aligned} \text{30\% chance: } & (90\% \times \$1,000,000) \times 1.005 + (10\% \times \$1,000,000) \times (1.50) = \\ & \$1,054,500 \end{aligned}$$

Both portfolio allocations meet the safety objective of \$900,000 (minimum value of \$900,450 for Allocation 1 and \$979,500 for Allocation 2).

Allocation 1 has a 90% chance of exceeding the aspirational level of \$1,050,000, however, whereas Allocation 2 has only a 30% chance of exceeding it. As a result, only Allocation 1 meets both the safety objective and the 75% probability of reaching the aspirational level. Thus, Allocation 1 is closest to the BPT optimal portfolio for Lundstrom.

READING

8

The Behavioral Biases of Individuals

by Michael M. Pompian, CFA

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LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. distinguish between cognitive errors and emotional biases;
<input type="checkbox"/>	b. discuss commonly recognized behavioral biases and their implications for financial decision making;
<input type="checkbox"/>	c. identify and evaluate an individual's behavioral biases;
<input type="checkbox"/>	d. evaluate how behavioral biases affect investment policy and asset allocation decisions and recommend approaches to mitigate their effects.

INTRODUCTION

1

Much of traditional economic and financial theory is based on the assumptions that individuals act rationally and consider all available information in the decision-making process and that markets are efficient. Behavioral finance challenges these assumptions and explores how individuals and markets actually behave. To differentiate the study of individual investor behavior from the study of collective market behavior, the subject of behavioral finance can be classified as **Behavioral Finance Micro** (BFMI) and **Behavioral Finance Macro** (BFMA).

BFMI examines the behavioral biases that distinguish individual investors from the rational decision makers of traditional finance. BFMA detects and describes market anomalies that distinguish markets from the efficient markets of traditional finance. In this reading, we focus on BFMI and the behavioral biases that individuals may exhibit when making financial decisions. BFMI attempts to observe and explain how individuals make financial decisions. This approach is in contrast to traditional theories of financial decision making that describe how people *should* make decisions under uncertainty.

Many prominent researchers have demonstrated that when people are faced with complex decision-making situations that demand substantial time and effort, they have difficulty devising completely rational approaches to developing and analyzing

various courses of action. Facing uncertainty and an abundance of information to process, individuals may not systematically describe problems, record necessary data, or synthesize information to create rules for making decisions. Instead, individuals may follow a more subjective, suboptimal path of reasoning to determine a course of action consistent with their basic judgments and preferences.

A decision maker may have neither the time nor the ability to arrive at a perfectly optimal decision. Individuals strive to make good decisions by simplifying the choices available, using a subset of the information available, and discarding some possible alternatives to choose among a smaller number. They are content to accept a solution that is “good enough” rather than attempting to find the optimal answer. In doing so, they may unintentionally bias the decision-making process. These biases may lead to irrational behaviors and decisions.

By understanding behavioral biases, investment professionals may be able to improve economic outcomes. This may entail identifying behavioral biases they themselves exhibit or behavioral biases of others, including clients. Once a behavioral bias has been identified, it may be possible to either moderate the bias or adapt to the bias so that the resulting financial decisions more closely match the rational financial decisions assumed by traditional finance. Knowledge of and integration of behavioral and traditional finance may lead to superior results.

Section 2 describes and broadly characterizes behavioral biases. Sections 3 and 4 discuss specific behavioral biases within two broad categories: cognitive errors and emotional biases. The discussion will include a description of the bias, potential consequences of the bias, detection of the bias, and guidance on moderating the effects of the bias. Section 5 considers the implications of behavioral biases for investment policy development and asset allocation decisions. A summary and practice problems conclude the reading.

2

CATEGORIZATIONS OF BEHAVIORAL BIASES

Dictionary definitions of bias include the following: a statistical sampling or testing error caused by systematically favoring some outcomes over others; a preference or an inclination, especially one that inhibits impartial judgment; an inclination or prejudice in favor of a particular viewpoint; an inclination of temperament or outlook, especially a personal and sometimes unreasoned judgment. In the context of this reading, we are considering biases that result in irrational financial decisions caused by faulty cognitive reasoning or reasoning influenced by feelings. The first dictionary definition of bias is consistent with faulty cognitive reasoning; the other three definitions are more consistent with reasoning influenced by feelings or emotions.

The simple categorization of distinguishing between biases based on faulty cognitive reasoning (**cognitive errors**) and those based on reasoning influenced by feelings or emotions (**emotional biases**) is used in this reading. Although researchers in the field of psychology have developed many different classifications and identifying factors to categorize and better understand biases, it is possible to see how each of these fit within the two categories. For example, psychologists’ factors include cognitive information-processing shortcuts or heuristics, memory errors, emotional and/or motivational factors, and such social influences as family upbringing or societal culture. The first two are cognitive; the last two are emotional. Some biases identified by psychologists are understood in relation to human needs, such as those identified by Maslow (e.g., physiological, safety, social, esteem, and self-actualizing). In satisfying these needs, people will generally attempt to avoid pain and seek pleasure. The avoidance of pain can be as subtle as avoiding acknowledging mistakes in order to maintain a positive self-image. The biases that help to avoid pain and produce pleasure may be classified

as emotional. Other biases found by psychologists are attributed to the particular way the brain perceives, forms memories, and makes judgments; the inability to do complex mathematical calculations, such as updating probabilities; and the processing and filtering of information. These can be classified as cognitive.

In summary, cognitive errors stem from basic statistical, information-processing, or memory errors; cognitive errors may be considered the result of faulty reasoning. Emotional biases stem from impulse or intuition; emotional biases may be considered to result from reasoning influenced by feelings. Behavioral biases, regardless of their source, may cause decisions to deviate from the assumed rational decisions of traditional finance.

2.1 Differences between Cognitive Errors and Emotional Biases

In this reading, behavioral biases are classified as either cognitive errors or emotional biases. This distinction is not only simple and easily understood, but it also provides a useful framework for understanding how effectively biases can be corrected for. If we think of decision making as occurring along a spectrum from the totally rational decision making of traditional finance to purely emotional decision making, cognitive errors are basic statistical, information-processing, or memory errors that cause the decision to deviate from the rational decisions of traditional finance. Emotional biases arise spontaneously as a result of attitudes and feelings that can cause the decision to deviate from the rational decisions of traditional finance.

Cognitive errors are more easily corrected than emotional biases. Individuals are better able to adapt their behaviors or modify their processes if the source of the bias is logically identifiable, even if not completely understood. For instance, an individual may not understand the complex mathematical process to update probabilities but may comprehend that the process initially used was incorrect. Cognitive errors can also be thought of as “blind spots” or distortions in the human mind. Cognitive errors do not result from emotional or intellectual predispositions toward certain judgments, but rather from subconscious mental procedures for processing information. Because cognitive errors stem from faulty reasoning, better information, education, and advice can often correct for them. Thus, most cognitive biases can be “moderated”—to moderate the impact of a bias is to recognize it and attempt to reduce or even eliminate it within the individual.

Because emotional biases stem from impulse or intuition—especially personal and sometimes unreasoned judgments—they are less easily corrected. It is generally agreed that an emotion is a mental state that arises spontaneously rather than through conscious effort. Emotions are related to feelings, perceptions, or beliefs about elements, objects, or relations between them and can be a function of reality or the imagination. In the world of investing, emotions can cause investors to make suboptimal decisions. Emotions may be undesired to the individual feeling them; he or she may wish to control them but often cannot. Thus, it may only be possible to recognize an emotional bias and “adapt” to it. When a bias is adapted to, it is accepted and decisions are made that recognize and adjust for it (rather than making an attempt to reduce or eliminate it).

The cognitive–emotional distinction will help us determine when and how to adjust for behavioral biases in financial decision making. However, it should be noted that specific biases may have some common aspects and that a specific bias may seem to have both cognitive and emotional aspects. Researchers in financial decision making have identified numerous specific behavioral biases. This reading will not attempt to discuss all identified biases. Rather, this reading will discuss some of the more publicized and recognized biases within the cognitive–emotional framework. This framework

will be useful in developing an awareness of biases, their implications, and ways of moderating their impact or adapting to them. The intent is not to develop a list of biases to be memorized but rather to create an awareness of biases so that financial decisions and resulting economic outcomes are potentially improved.

In Sections 3 and 4, specific behavioral biases will be discussed. Cognitive errors will be discussed in Section 3 and emotional biases in Section 4. For each bias we will 1) describe the bias, including evidence supporting the existence of the bias; 2) describe the consequences of the bias; and 3) offer guidance on detecting and overcoming the bias. We will limit our focus to gauging the presence or absence—not the magnitude—of each bias discussed. That is, we will not try to measure how strongly the bias is exhibited, but rather we will describe the behavioral bias, its potential consequences, and the detection of and correction for the behavioral bias. In detecting a bias, we will identify statements or thought processes that may be indicative of the bias. Diagnostic tests of varying degrees of complexity are available to detect biases but are beyond the scope of this reading.¹

3

COGNITIVE ERRORS

We will now review nine specific cognitive errors, their implications for financial decision making, and suggestions for correcting for them. We classify cognitive errors into two categories. The first category contains “belief perseverance” biases. In general, belief perseverance is the tendency to cling to one’s previously held beliefs irrationally or illogically. The belief continues to be held and justified by committing statistical, information-processing, or memory errors. A second category of cognitive error has to do with “processing errors,” describing how information may be processed and used illogically or irrationally in financial decision making.

The belief perseverance biases discussed are conservatism, confirmation, representativeness, illusion of control, and hindsight. The processing errors discussed are anchoring and adjustment, mental accounting, framing, and availability.

In this reading, the individuals of interest are “financial market participants” (“FMPs”) engaged in financial decision making. These include both individual investors and financial services professionals.

3.1 Belief Perseverance Biases

Belief perseverance biases are closely related to the psychological concept of **cognitive dissonance**. Cognitive dissonance is the mental discomfort that occurs when new information conflicts with previously held beliefs or cognitions. To resolve this dissonance, people may notice only information of interest (selective exposure), ignore or modify information that conflicts with existing cognitions (selective perception), or remember and consider only information that confirms existing cognitions (selective retention). Aspects of these behaviors are contained in the biases categorized as belief perseverance.

3.1.1 Conservatism Bias

Conservatism bias is a belief perseverance bias in which people maintain their prior views or forecasts by inadequately incorporating new information. This bias has aspects of both statistical and information-processing errors. Academic studies have demonstrated that conservatism causes individuals to overweight initial beliefs about

¹ Some diagnostic tests are included in *Behavioral Finance and Wealth Management* by Pompian (2006).

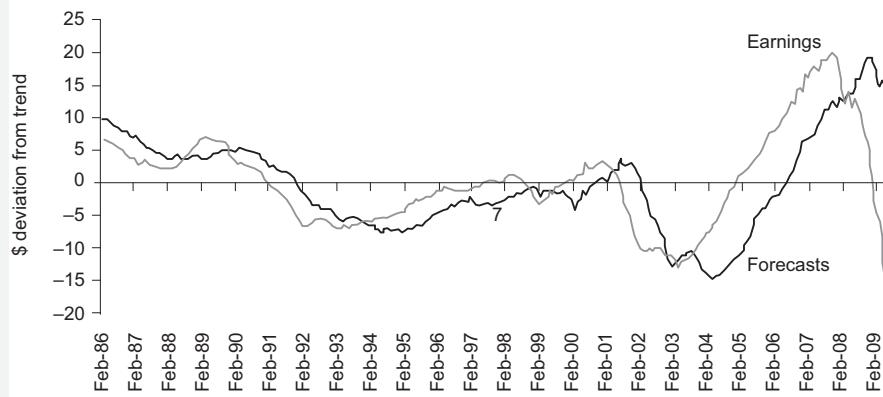
probabilities and outcomes and under-react to new information; they fail to modify their beliefs and actions to the extent rationally justified by the new information. In Bayesian terms, they tend to overweight the base rates² and underweight the new information, resulting in revised beliefs about probabilities and outcomes that demonstrate an underreaction to the new information. As a result of conservatism bias, FMPs may underreact to or fail to act on new information and continue to maintain beliefs close to those based on previous estimates and information.

EXAMPLE 1

Conservatism in Action

James Montier writes, “The stock market has a tendency to underreact to fundamental information—be it dividend omissions, initiations or an earnings report.”³ When discussing the behavior of security analysts, Montier explains, “[Exhibit 1] was constructed by de-trending operating earnings and the analyst forecasts of those earning so that the chart plots deviations from trend in dollars-per-share terms. It clearly shows that analysts lag reality. They only change their mind when there is irrefutable proof they were wrong, and then they only change their minds very slowly... In many ways, 2008 was a case study in financial conservatism. The recession that was engulfing all the major economies was eerily like watching a slow motion train wreck... The analysts seemed to be able to grasp this, and went away to cut their numbers. Of course, the first thing they did was talk to their companies... [which] unsurprisingly said that the recession wouldn’t affect them (even the cyclically exposed ones). After hearing this, the analysts came back to us and said, ‘We can’t cut our numbers!’”⁴ Discuss Montier’s analysis in the context of biases of individuals.

Exhibit 1 Analysts Lag Reality



² The base rate is the probability of the event without the new information.

³ Montier (2002).

⁴ Montier (2010).

Solution:

In relating conservatism to security analysts, Montier provides clear evidence of the conservatism bias in action: The analysts maintain their forecasts even when presented with new information. The behavior observed in security analysts can logically be extended to individual investors who are likely to engage in similar behavior when managing their own investment portfolios.

Consequences of Conservatism Bias As a result of conservatism bias, FMPs may do the following:

- Maintain or be slow to update a view or a forecast, even when presented with new information. For example, if an investor purchases a security of a pharmaceutical company based on the belief that the company is about to receive regulatory approval for a new drug, and then the company announces that it is experiencing problems getting the approval, the investor may cling to his initial valuation of the company and fail to respond or respond slowly to the new information. As a result, the investor may hold the security longer than a rational decision maker would.
- Opt to maintain a prior belief rather than deal with the mental stress of updating beliefs given complex data. This behavior relates to an underlying difficulty in processing new information. For example, if an investor purchases a security based on the belief that the company is entering a period of significant earnings growth, and then the company announces its growth rate may appear lower than expected because of a number of difficult-to-interpret accounting changes, the investor may maintain the prior belief rather than attempt to decipher the fundamental impact, if any, reflected in the accounting changes. As a result, the investor may hold the security longer than a rational decision maker would.

Detection of and Guidance for Overcoming Conservatism Bias The effect of conservatism bias may be corrected for or reduced by properly analyzing and weighting new information. The first step is to be aware that a bias exists. If FMPs find themselves ignoring new information or not adequately processing new information on the basis that the information is not relevant, is difficult to understand, or would not change beliefs, a conservatism bias may exist.

Hirschleifer (2001) provides evidence that the processing of new information and the updating of beliefs are inversely correlated with the effort involved in processing the information and updating the beliefs. He terms this effort cognitive cost. The higher the cognitive cost, the less likely information will be processed and beliefs updated. Information that is abstract and statistical is cognitively costly, and it thus receives less weighting. As a result, the base rate is overweighted. Information that is cognitively inexpensive (easily processed) may receive a higher weighting. As a result, individuals may overreact to information that is easily processed and may even underweight base rates. The costly processing idea can explain base rate overweighting and underweighting.

When new information is presented, the FMP should ask such questions as, “How does this information change my forecast?” or “What impact does this information have on my forecast?” Specifically, FMPs should react decisively to new information and avoid retaining old forecasts by disregarding new information. This reaction does not imply action before analysis. FMPs should conduct careful analysis incorporating the new information and then respond appropriately. When an appropriate course of action becomes clear, even if it deviates from the course of action based on previous information and beliefs, it should be implemented without hesitation.

When investors are ignoring information because it is difficult to interpret or understand, they should seek advice from a professional who can either explain how to interpret the data or can explain the action implications of the data to the satisfaction of the investor. Otherwise, investors may fail to make appropriate financial decisions. Inappropriate decisions may include making or failing to make investments because they are poorly understood.

3.1.2 Confirmation Bias

Confirmation bias is a belief perseverance bias in which people tend to look for and notice what confirms their beliefs, and to ignore or undervalue what contradicts their beliefs. This behavior has aspects of selective exposure, perception, and retention and may be thought of as a selection bias. It is an all too natural response to cognitive dissonance and reflects an ability to convince ourselves of what we want to believe by giving more weight to evidence that supports our beliefs and to ignore or modify evidence that conflicts with our beliefs.

Numerous studies have demonstrated that people generally place excessive weight on confirmatory information; that is, they place greater weight on information that supports their beliefs. Information is considered positive if it supports their beliefs and negative if it fails to support or refutes their beliefs. Thomas Gilovich, a researcher in the field of human psychology, notes that, “The most likely reason for the excessive influence of confirmatory information is that it is easier to deal with cognitively.”⁵ Researchers are sometimes guilty of confirmation bias when they set up experiments or frame their data in ways that tend to confirm their hypotheses. They compound the problem by proceeding in ways that avoid dealing with data that would contradict their hypotheses.

All FMPs—whether individual investors, analysts, investment advisers, or fund managers—may, after making an investment decision, tend to notice and consider information in a manner consistent with resolving cognitive dissonance. They may notice and consider only confirmatory information and ignore or modify contradictory information. Most experienced private wealth advisers have dealt with a client who conducts some research and insists on adding a particular investment to his portfolio. Unfortunately, the client may have failed to consider how the investment fits in his portfolio, as well as evidence of its fundamental value. This type of client may insist on continuing to hold the investment, even when the adviser recommends otherwise, because the client’s follow-up research seeks only information that confirms his belief that the investment is still a good value. The confirmation bias is not limited to individual investors; all FMPs should be wary of the potential confirmation biases within themselves.

Consequences of Confirmation Bias In the investment world, confirmation bias is exhibited repeatedly. As a result of confirmation bias, FMPs may do the following:

- Consider only the positive information about an existing investment and ignore any negative information about the investment.
- Develop screening criteria and ignore information that either refutes the validity of the screening criteria or supports other screening criteria. As a result, some good investments that do not meet the screening criteria may be ignored; conversely, some bad investments that do meet the screening criteria may be made.

⁵ Gilovich (1993).

- Under-diversify portfolios, leading to excessive exposure to risk. FMPs may become convinced of the value of a single company and its stock. They ignore negative news about the company and its stock, and they gather and process only information confirming that the company is a good investment. They build a large position and eventually own a poorly diversified portfolio.
- Hold a disproportionate amount of their investment assets in their employing company's stock because they believe in their company and are convinced of its favorable prospects. Favorable information is cited, and unfavorable information is ignored. If the employee was to acknowledge unfavorable information, the associated mental discomfort might make work very difficult for the employee.

Detection of and Guidance for Overcoming Confirmation Bias The effect of confirmation bias may be corrected for or reduced by actively seeking out information that challenges your beliefs. The conscious effort to gather and process negative information (information that challenges a belief), as well as positive information, provides more complete information on which to base a decision. Even well-informed decisions can lead to unfavorable results; however, making the extra effort to gather complete information, positive and negative, will likely result in better decisions.

Another useful step is to get corroborating support for an investment decision. For example, if investment selections are based on criteria confirming an existing belief, such as stocks breaking through their 52-week highs, it is usually advisable to obtain supporting information (e.g., fundamental research on the company, industry or sector information) to assure that a good investment is being made. Accepting an investment idea unquestioningly and confirming it through purchases is not a proven investment strategy. Additional research is highly recommended.

3.1.3 Representativeness Bias

Representativeness bias is a belief perseverance bias in which people tend to classify new information based on past experiences and classifications. They believe their classifications are appropriate and place undue weight on them. This bias occurs because people attempting to derive meaning from their experiences tend to classify objects and thoughts into personalized categories. When confronted with new information, they use those categories even if the new information does not necessarily fit. They rely on a “best fit” approximation to determine which category should provide a frame of reference from which to understand the new information.

Although this perceptual framework provides an expedient tool for processing new information, it may lead to statistical and information-processing errors. The new information superficially resembles or is *representative* of familiar elements already classified, but in reality it can be very different. In these instances, the classification reflex deceives people, producing an incorrect understanding that often persists and biases all future thinking about the information. *Base-rate neglect* and *sample-size neglect* are two types of representativeness bias that apply to FMPs. In Bayesian terms, FMPs tend to underweight the base rates and overweight the new information—resulting in revised beliefs about probabilities and outcomes that demonstrate an overreaction to the new information.

Base-Rate Neglect In **base-rate neglect**, the base rate or probability of the categorization is not adequately considered. For example, an FMP attempting to determine the potential success of an investment in Company ABC might use a familiar, easy to understand classification scheme and categorize Company ABC as a “growth stock.” This classification is based on some information about ABC that is consistent with the FMP’s beliefs about growth companies, but it ignores the base probability that a company is a growth company. The FMP draws conclusions about ABC’s risks and rewards based

on that categorization. FMPs often follow this erroneous path because it is an easy alternative to the diligent research actually required when evaluating investments. To rephrase this error, some FMPs rely on *stereotypes* when making investment decisions without adequately incorporating the base probability of the stereotype occurring.

Sample-Size Neglect A second type of representativeness bias is **sample-size neglect**. In sample-size neglect, FMPs incorrectly assume that small sample sizes are *representative* of populations (or “real” data). Some researchers call this phenomenon the “law of small numbers.” This bias reflects erroneous beliefs about the laws of probability; they mistakenly believe that a small sample is representative of or similar in characteristics to the population. When people do not initially comprehend a trend or pattern reflected in a series of data, they may make assumptions relying on only a few data points. Individuals prone to sample-size neglect are quick to treat properties reflected in small samples as properties that accurately describe large pools of data. They overweight the information in the small sample.

EXAMPLE 2

Representativeness

APM Company is a large, 50-year old auto parts manufacturer having some business difficulties. It has previously been classified as a value stock. Jacques Verte is evaluating the future prospects of the company. Over the 50-year life of APM, there have been few failures of large auto parts manufacturers even given periods of difficulty. There have been a number of recent headlines about auto parts manufacturers having business and financial difficulty and potentially going out of business. He is considering two possibilities:

- A APM will solve its difficulties, the company's performance will revert to the mean, and the stock will again be a value stock.
 - B APM will go out of business, and the stock will become valueless.
- 1 Is Scenario A or B more likely? Explain why.
 - 2 If Verte is subject to representativeness bias, is he more likely to classify APM into A or B? Explain why.

Solution to 1:

Scenario A. It is more likely that APM will solve its difficulties, the company's performance will revert to the mean, and the stock will again be a value stock. The base rate, based on 50 years of data, is that more auto parts companies revert to the mean rather than go out of business.

Solution to 2:

Verte is likely to classify APM as B, predicting that it will go out of business because he read some headlines about other auto parts manufacturers going out of business. Verte, in classifying APM as likely to go out of business, may be guilty of both base-rate neglect and sample-size neglect. He has potentially ignored the base-rate information that far more auto parts manufacturers revert to the mean rather than go out of business, and he has assumed that the small sample of failing auto parts manufacturers is representative of all auto parts manufacturers.

Consequences of Representativeness Bias A wide variety of FMP behaviors indicate susceptibility to the premise of the representativeness bias: FMPs often overweight new information and small samples because they view the information or sample as representative of the population as a whole. As a result of representativeness bias, FMPs may do the following:

- Adopt a view or a forecast based almost exclusively on new information or a small sample. For example, when evaluating investment managers, FMPs may place undue emphasis on high returns during a one-, two-, or three-year period, ignoring the base probability of such a return occurring. As a result, the investor may hire an investment manager without adequately considering the likelihood of such returns continuing. This situation may also result in high investment manager turnover as the investor changes investment managers based on short-term results.
- Update beliefs using simple classifications rather than deal with the mental stress of updating beliefs given complex data. This issue relates to an underlying difficulty (cognitive cost) in properly processing new information. For example, if an investor purchases a security based on the belief that the company is entering a period of significant earnings growth, and then the company announces that its growth rate may appear lower than expected because of a number of difficult-to-interpret accounting changes, the investor may simply reclassify the stock rather than attempt to decipher the fundamental impact, if any, reflected in the accounting changes. As a result, the investor may sell the security when fundamentals would not justify such a decision.

Detection of and Guidance on Overcoming Representativeness Bias In both base-rate neglect and sample size neglect, investors ignore the laws of probability to satisfy their need for patterns. FMPs need to be aware of statistical mistakes they may be making and constantly ask themselves if they are overlooking the reality of the investment situation being considered.

For example, an FMP might conclude that a mutual fund manager possesses remarkable skill based on performance over a short time period, such as one, two, or three years. However, over a short time period, a manager's track record may benefit as much from luck as from skill. Several studies demonstrate this concept.

A study conducted by Vanguard Investments Australia (2004), later released by Morningstar, analyzes the five best-performing funds from 1994 to 2003. The results of the study are as follows:

- Only 16 percent of top five funds made it to the following year's list.
- Top five funds averaged 15 percent lower returns the following year.
- Top five funds barely beat the market the following year (by 0.3 percent).
- 21 percent of all top five funds ceased to exist within the following 10 years.

Barras, Scaillet, and Wermers (2010) evaluate the skill of active managers. Their study was intended to make general statements about the mutual fund industry rather than about any single mutual fund. They evaluate performance over the full set of mutual funds and separate them into three categories—skilled (generating positive alpha), unskilled (generating negative alpha), and zero-alpha. They add to previous research by explicitly accounting for skill and luck. Earlier empirical work either assumes no luck or full luck, thus producing biased conclusions about the prevalence of truly skilled and truly unskilled fund managers. Barras et al. conclude that 75.4 percent of the 2,076 funds analyzed were zero-alpha funds over their lifetimes. Of

the remainder, only 0.6 percent were skilled and 24.0 percent were unskilled. In sum, Barras et al. conclude that the majority of actively managed domestic equity mutual funds have generated at most zero alpha after adjusting for luck, trading costs, and fees.

DALBAR's 2008 *Quantitative Analysis of Investor Behavior*⁶ demonstrates that investors tend to buy into a fund immediately following rapid price appreciation. They seem to categorize the funds as good investments based on this recent information. These periods tend to precede a subsequent decline in the fund's performance. Then, when prices fall, FMPs sell their holdings and search for the next hot fund. Based on an analysis of actual investor behavior over the 20 years ended 31 December 2007, the average equity fund investor earned an annualized return of just 4.48 percent—underperforming the S&P 500 by more than 7 percent and outpacing inflation by a mere 1.44 percent. Fixed-income investors fared far worse, losing an average of 1.49 percent in purchasing power per year. Asset allocation fund investors did a bit better, beating inflation by 0.41 percent per year.⁷

These results are consistent with Bogle (2005). Bogle illustrates that returns earned by a group of investors must fall short of the reported market returns or mutual fund returns by the amount of the aggregate costs the investors incur. Thus, we can conclude that the additional costs of moving in and out of funds and lack of performance persistence will generally result in returns lower than those expected by investors. Moving in and out of investments based on categorizations that place undue reliance on recent performance and new information is likely to result in excessive trading and inferior performance results.

Prudent methods for identifying appropriate long-term investments exist. Use an asset allocation strategy to increase the likelihood of better long-term portfolio returns. Invest in a diversified portfolio to meet financial goals, and stick with it. The following questions should help FMPs avoid the futility of chasing returns and also help them select appropriate investments.

- 1 How does the fund under consideration perform relative to similarly sized and similarly styled funds?
- 2 What is the tenure of the managers and advisers at the fund?
- 3 Are the managers well-known and/or highly regarded?
- 4 Has the fund consistently pursued its strategy, or has its style drifted during different market conditions?

To counteract the effects of the representativeness bias when considering returns, many practitioners use what has become known as the “periodic table of investment returns,” as shown in Exhibit 2.

6 DALBAR has conducted its annual *Quantitative Analysis of Investor Behavior* since 1994. The analysis measures the effect of investor decisions to transact into and out of mutual funds on returns. The results consistently show that the average investor earns less than indicated on mutual fund performance reports. www.QAIB.com

7 Average stock investor, average bond investor, and average asset allocation investor performance results are calculated using data supplied by the Investment Company Institute. Investor returns are represented by the change in total mutual fund assets after excluding sales, redemptions, and exchanges. This method of calculation captures realized and unrealized capital gains, dividends, interest, trading costs, sales charges, fees, expenses, and any other costs. After calculating investor returns in dollar terms, two percentages are calculated for the period examined: total investor return rate and annualized investor return rate. Total return rate is determined by calculating the investor return dollars as a percentage of the net of the sales, redemptions, and exchanges for the period.

Exhibit 2 Sample of a Periodic Table of Investment Returns

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Highest Return	MSCI Em Mkts 32.59%	MSCI Em Mkts 39.78%	Barclays Agg Fx Inc 5.24%	MSCI Em Mkts 79.02%	Russell 2000 26.85%	NCREIF Property 14.26%	MSCI Em Mkts 18.63%	Russell 2000 38.82%	S&P 500 13.69%	NCREIF Property 13.33%
	MSCI EAFE 26.34%	Cambridge Private Eq. 17.69%	Barclays US TIPS -2.35%	Barclays Corp HY 58.21%	Cambridge Private Eq. 19.42%	Barclays US TIPS 13.56%	MSCI EAFE 17.32%	S&P 500 32.39%	Cambridge Private Eq. 12.81%	S&P 500 1.38%
	Cambridge Private Eq. 25.40%	NCREIF Property 15.85%	NCREIF Property -6.46%	MSCI EAFE 31.78%	MSCI Em Mkts 19.20%	Cambridge Private Eq. 10.99%	Russell 2000 16.35%	MSCI EAFE 22.78%	NCREIF Property 11.82%	Barclays Agg Fx Inc 0.55%
	Russell 2000 18.37%	CS Hedge Fund 12.56%	CS Hedge Fund -19.07%	Russell 2000 27.17%	Bloomberg Commodity 16.67%	Barclays Agg Fx Inc 7.84%	S&P 500 16.00%	Cambridge Private Eq. 22.28%	Diversified 6.10%	Diversified -0.50%
	NCREIF Property 16.59%	Barclays US TIPS 11.63%	Cambridge Private Eq. -22.37%	S&P 500 26.47%	Barclays Corp HY 15.12%	Barclays Corp HY 4.98%	Barclays Corp HY 15.81%	Diversified 14.70%	Barclays Agg Fx Inc 5.97%	CS Hedge Fund -0.71%
	S&P 500 15.79%	MSCI EAFE 11.17%	Diversified -25.10%	Diversified 20.20%	S&P 500 15.06%	S&P 500 2.11%	Cambridge Private Eq. 13.27%	NCREIF Property 10.98%	Russell 2000 4.89%	MSCI EAFE -0.81%
	CS Hedge Fund 13.86%	Bloomberg Commodity 11.08%	Barclays Corp HY -26.16%	Bloomberg Commodity 18.72%	NCREIF Property 13.11%	Diversified 1.10%	Diversified 12.60%	CS Hedge Fund 9.73%	CS Hedge Fund 4.13%	Barclays US TIPS -1.44%
	Diversified*	Diversified 13.20%	Russell 2000 -33.79%	CS Hedge Fund 18.57%	Diversified 12.90%	CS Hedge Fund -2.52%	NCREIF Property 10.54%	Barclays Corp HY 7.44%	Barclays US TIPS 3.64%	Russell 2000 -4.41%
	Barclays Corp HY 11.85%	Barclays Agg Fx Inc 6.97%	Bloomberg Commodity -36.61%	Cambridge Private Eq. 13.98%	CS Hedge Fund 10.95%	Russell 2000 -4.18%	CS Hedge Fund 7.67%	Barclays Agg Fx Inc -2.02%	Barclays Corp HY 2.45%	Barclays Corp HY -4.47%
	Barclays Agg Fx Inc 4.33%	S&P 500 5.49%	S&P 500 -37.00%	Barclays US TIPS 11.41%	MSCI EAFE 7.75%	MSCI EAFE -12.14%	Barclays US TIPS 6.98%	MSCI Em Mkts -2.27%	MSCI Em Mkts -1.82%	MSCI Em Mkts -14.60%
Lowest Return	Barclays US TIPS 0.41%	Barclays Corp HY 1.87%	MSCI EAFE -43.38%	Barclays Agg Fx Inc 5.93%	Barclays Agg Fx Inc 6.54%	Bloomberg Commodity -13.37%	Barclays Agg Fx Inc 4.21%	Barclays US TIPS -8.61%	MSCI EAFE -4.90%	Bloomberg Commodity -24.70%
	Bloomberg Commodity -2.71%	Russell 2000 -1.57%	MSCI Em Mkts -53.18%	NCREIF Property -16.86%	Barclays US TIPS 6.31%	MSCI Em Mkts -18.17%	Bloomberg Commodity -1.14%	Bloomberg Commodity -9.58%	Bloomberg Commodity -17.04%	

* "Diversified" is the median return of the funds in Callan Associates' mid-sized defined-benefit fund universe.

Source: Callan Associates

Exhibit 2 shows that asset class returns are highly variable. Many FMPs fail to heed the advice offered by the chart—namely, that it is nearly impossible to accurately predict which asset class will be the best performer from one year to the next. Thus, diversification is prudent (note how the diversified portfolio consistently appears near the center of each column). Practitioners would be wise to present this chart when establishing asset allocations with new clients to emphasize the advantages of diversification over return chasing.

When FMPs sense that base-rate or sample-size neglect may be a problem, they should ask the following question: "What is the probability that X (the investment under consideration) belongs to Group A (the group it resembles or is considered representative of) versus Group B (the group it is statistically more likely to belong to)?" This question, or a similar question, will help FMPs think through whether they are failing to consider base-rate probabilities or neglecting the law of small numbers and thus inaccurately assessing a particular situation. It may be necessary to do more research to determine if a statistical error has indeed been made. In the end, this process should improve investment decisions.

3.1.4 Illusion of Control Bias

Illusion of control bias is a bias in which people tend to believe that they can control or influence outcomes when, in fact, they cannot. Langer (1983) defines the illusion of control bias as the “expectancy of a personal success probability inappropriately higher than the objective probability would warrant.” Langer finds that choices, task familiarity, competition, and active involvement can all inflate confidence and generate such illusions. For example, Langer observed that people permitted to select their own numbers in a hypothetical lottery game were willing to pay a higher price per ticket than subjects gambling on randomly assigned numbers. Since this initial study, many other researchers have uncovered similar situations, where people perceived themselves as possessing more control than they did, inferred causal connections where none existed, or displayed surprisingly great certainty in their predictions for the outcomes of chance events.

Consequences of Illusion of Control As a result of illusion of control bias, FMPs may do the following:

- Trade more than is prudent. Researchers have found that traders, especially online traders, believe that they have “control” over the outcomes of their investments. This view leads to excessive trading, which may lead to lower realized returns than a strategy where securities are held longer and traded less frequently.
- Lead investors to inadequately diversify portfolios. Researchers have found that some investors prefer to invest in companies that they may feel they have some control over, like the companies they work for, leading them to hold concentrated positions. In fact, most investors have almost no control over the companies they work for. If the company performs poorly, the investor may experience both the loss of employment and investment losses.

Detection of and Guidelines for Overcoming Illusion of Control Bias There are some useful guidelines to help investors detect and overcome illusion of control bias. The first and most basic idea is that investors need to recognize that successful investing is a probabilistic activity. The first step on the road to understanding illusion of control bias is to be aware that global capitalism is highly complex, and even the most powerful investors have little control over the outcomes of the investments they make.

Second, it is advisable to seek contrary viewpoints. As you contemplate a new investment, take a moment to ponder any considerations that might weigh against the trade. Ask yourself: Why am I making this investment? Is this investment part of an overall plan? What are the downside risks? What might go wrong? When will I sell? These important questions can help you logically evaluate an investment decision before implementation.

Finally, it is critical to keep records. Once you have decided to move forward with an investment, an effective way to prevent illusions of control is to maintain records of your transactions, including reminders outlining the rationale behind each trade. Write down some of the important features of each investment that you make, and emphasize those attributes that you have determined to be in favor of the investment’s success.

Rationally, we know that returns on long-term investments are not impacted by the short-term beliefs, emotions, and impulses that often surround financial transactions. Success, or the lack thereof, is usually a result of such uncontrollable factors as corporate performance or general economic conditions. During periods of market turmoil, it can be difficult to keep this fact in mind. One of the best ways to prevent your biases from affecting your decisions is to keep the rational side of your brain as engaged as possible. Investing success is ultimately achieved by those who can conquer the daily psychological challenges and maintain a long-term perspective.

3.1.5 Hindsight Bias

Hindsight bias is a bias with selective perception and retention aspects. People may see past events as having been predictable and reasonable to expect. This behavior is based on the obvious fact that outcomes that did occur are more readily evident than outcomes that did not occur. Also, people tend to remember their own predictions of the future as more accurate than they actually were because they are biased by the knowledge of what has actually happened. To alleviate the discomfort associated with the unexpected, people tend to view things that have already happened as being relatively inevitable and predictable. This view is often caused by the reconstructive nature of memory. When people look back, they do not have perfect memory; they tend to “fill in the gaps” with what they prefer to believe. In doing so, people may prevent themselves from learning from the past.

In a classic example of hindsight bias, Fischhoff (1975) describes an experiment in which he asked subjects to answer general knowledge questions from almanacs and encyclopedias. Next, he gave his subjects the correct answers and asked them to recall their original ones. Fischhoff found that, in general, people overestimate the quality of their initial knowledge and forget their initial errors. Hindsight bias is a serious problem for historically minded market followers. Once an event is part of history, there is a tendency to see the sequence that led to it as inevitable, as if uncertainty and chance were banished. As Posner (1998) notes, outcomes exert irresistible pressure on their interpretations. In hindsight, poorly reasoned decisions with positive results may be described as brilliant tactical moves, and poor results of well-reasoned decisions may be described as avoidable mistakes.

Consequences of Hindsight Bias As a result of hindsight bias, FMPs may do the following:

- Overestimate the degree to which they predicted an investment outcome, thus giving them a false sense of confidence. For example, when an investment appreciates for unforeseen reasons, FMPs may rewrite their own memories to reflect those reasons. The hindsight bias may cause FMPs to take on excessive risk, leading to future investment mistakes.
- Cause FMPs to unfairly assess money manager or security performance. Based on their ability to look back at what has taken place in securities markets, performance is compared against what has happened as opposed to expectations. For example, a given manager may have followed his or her strategy faithfully, and possibly even ranked near the top of the relevant peer group, but the investment results may be disappointing compared to another segment of the market or the market as a whole.

Detection of and Guidelines for Overcoming Hindsight Bias Once understood, hindsight bias should be recognizable. FMPs need to be aware of the possibility of hindsight bias and ask such questions as, “Am I re-writing history or being honest with myself about the mistakes I made?” Achieving success with investments requires investors to recognize and come to terms with mistakes. This approach is contrary to human nature. However, understanding how markets work and why investments go wrong is critical to achieving investment success.

To guard against hindsight bias, FMPs need to carefully record and examine their investment decisions, both good and bad, to avoid repeating past investment mistakes. In addition, FMPs should constantly remind themselves that markets move in cycles and that good managers stay true to their strategies through good times and bad. Expectations must be managed; there will inevitably be periods when even good

managers underperform the broader market. Education is critical here. It is important that all investment managers be evaluated relative to appropriate benchmarks and peer groups.

3.2 Information-Processing Biases

The second category of cognitive errors includes information-processing errors or biases. Information-processing biases result in information being processed and used illogically or irrationally. As opposed to belief perseverance biases, these are less related to errors of memory or in assigning and updating probabilities and more to do with how information is processed.

3.2.1 Anchoring and Adjustment Bias

Anchoring and adjustment bias is an information-processing bias in which the use of a psychological heuristic influences the way people estimate probabilities. When required to estimate a value with unknown magnitude, people generally begin by envisioning some initial default number—an “anchor”—which they then adjust up or down to reflect subsequent information and analysis. Regardless of how the initial anchor was chosen, people tend to adjust their anchors insufficiently and produce end approximations that are, consequently, biased. This bias is closely related to the conservatism bias. In the conservatism bias, people overweight past information compared to new information. In anchoring and adjustment, people place undue weight on the anchor. People anchor and adjust because they are generally better at estimating relative comparisons than absolute figures.

For example, FMPs exhibiting this bias are often influenced by purchase “points,” or arbitrary price levels or price indexes, and tend to cling to these numbers when facing questions like, “Should I buy or sell this security?” or “Is the market overvalued or undervalued right now?” This approach is especially prevalent when the introduction of new information regarding the security further complicates the situation. Rational investors treat these new pieces of information objectively, and they do not reflect upon purchase prices or target prices in deciding how to act. Investors with an anchoring and adjustment bias, however, perceive new information through a warped lens. They place undue emphasis on statistically arbitrary, psychologically determined anchor points. Decision making therefore deviates from neo-classically prescribed “rational” norms. Readers interested in academic research on anchoring and adjustment behavior should see Slovic and Lichtenstein (1971), Joyce and Biddle (1981), and Butler (1986), among other studies.

Consequences of Anchoring and Adjustment Bias As a result of anchoring and adjustment bias, FMPs may stick too closely to their original estimates when new information is learned. For example, if the FMP originally estimates next year’s earnings for a company as \$2.00 per share and the company experiences difficulties during the year, FMPs may not adequately adjust the \$2.00 estimate given the difficulties. They remain “anchored” to the \$2.00 estimate. This mindset is not limited to downside adjustments; the same phenomenon occurs when companies have upside surprises. In another example, FMPs may become anchored to the “economic states” of countries or companies. In the 1980s, Japan was viewed as a model economy, and many FMPs believed it would remain dominant for decades. It took many FMPs a significant period to revise their beliefs about Japan when its growth slowed. FMPs can similarly anchor on beliefs about companies.

Detection of and Guidelines for Overcoming Anchoring and Adjustment Bias The primary action FMPs can take is to consciously ask questions that may reveal an anchoring and adjustment bias. Examples of such questions include, “Am I holding

onto this stock based on rational analysis, or am I trying to attain a price that I am anchored to, such as the purchase price or a high water mark?" and "Am I making this market or security forecast based on rational analysis, or am I anchored to last year's market levels or ending securities prices?"

It is important to remember that past prices, market levels, and reputation provide little information about an investment's future potential and thus should not influence buy-and-sell decisions to any great extent. This advice is particularly relevant when analyzing the recommendations of securities' analysts. FMPs should look at the basis for any recommendations to see whether they are anchored to previous estimates or based on an objective, rational view of changes in company fundamentals.

3.2.2 Mental Accounting Bias

Mental accounting bias is an information-processing bias in which people treat one sum of money differently from another equal-sized sum based on which mental account the money is assigned to. Richard Thaler (1980) describes mental accounting as a process in which people code, categorize, and evaluate economic outcomes by grouping their assets into any number of non-fungible (non-interchangeable) mental accounts. This method contradicts rational economic thought because money is inherently fungible. Mental accounts are based on such arbitrary classifications as the source of the money (e.g., salary, bonus, inheritance, gambling) or the planned use of the money (e.g., leisure, necessities). According to traditional finance theory, FMPs should consider portfolios holistically in a risk/return context.

Consequences of Mental Accounting Bias A potentially serious problem that mental accounting creates is the placement of investments into discrete "buckets" without regard for the correlations among these assets. Meir Statman (1999) contends that the difficulty individuals have in addressing the interaction of different investments leads investors to construct portfolios in a layered pyramid format. Statman (2008) also notes that behavioral portfolio theory is a goal-based theory. Each layer of the portfolio addresses a particular investment goal (such as money for retirement) that is independent of other investment goals (such as college funds). Investors may target such low-risk investments as cash and money market funds to preserve wealth, bonds and dividend-paying stocks to provide income, and such risky investments as emerging market stocks and initial public offerings (IPOs) in an attempt to get rich.

As a result of mental accounting bias, FMPs may do the following:

- Neglect opportunities to reduce risk by combining assets with low correlations. Inefficient investing may result from offsetting positions in the various layers (Shefrin and Statman 1984). This approach can lead to suboptimal aggregate portfolio performance (Kroll, Levy, and Rapoport 1988).
- Irrationally distinguish between returns derived from income and those derived from capital appreciation. Although many people feel the need to preserve capital appreciation (principal), they focus on the idea of spending income that the principal generates. As a result, many FMPs chase income streams, unwittingly eroding principal in the process. Consider a high-yield or "junk" bond that pays a high dividend but can suffer significant loss of principal if the company issuing the bond experiences financial difficulties. Mental accounting can make such instruments appear tremendously appealing, but it is also possible that the original investment could shrink, ultimately reducing or even eliminating income payments.

Detection of and Guidelines for Overcoming Mental Accounting Bias An effective way to detect and overcome mental accounting behavior that causes investors to place money in discrete investment "buckets" is to recognize the drawbacks of engaging in

this behavior. The primary drawback is that correlations between investments are not taken into account when creating an overall portfolio. FMPs should go through the exercise of combining all of their assets onto one spreadsheet or other summary document to see the true asset allocation of various mental account holdings. This exercise often produces information that is surprising when seen as whole, such as higher cash balances than expected. Going through this process will show the suboptimal nature of the portfolio constructed using mental accounting. The logical next step would be to create a portfolio strategy taking all assets into consideration.

With regard to the income versus total return issue, an effective way to manage the tendency of some FMPs to treat investment income and capital appreciation differently is to focus on total return. FMPs should learn the benefits of integrating the two sources of return, allocating sufficient assets to lower income investments to allow principal to continue to grow even after inflation.

3.2.3 *Framing Bias*

Framing bias is an information-processing bias in which a person answers a question differently based on the way in which it is asked (framed). How information is processed is dependent upon how the question is framed. In actual choice contexts, a decision maker has flexibility in how to think about a problem. A decision frame is the decision maker's subjective conception of the acts, outcomes, and contingencies associated with a particular choice. The frame that a decision maker adopts is controlled partly by the formulation of the problem and partly by the norms, habits, and personal characteristics of the decision maker. It is often possible to frame a given decision problem in more than one way.

A framing effect results in a change of preferences between options as a function of the variation of frames, perhaps through variation of the formulation of the decision context. For example, a decision may be presented within a *gain* context (25 percent of the people with disease X given medicine Z will survive) or within a *loss* context (75 percent of the people with disease X will die even if given medicine Z). In the first presentation, people with disease X tend to adopt a positive outlook based on a gain frame of reference and are generally less likely to engage in risky behavior; they are risk-averse because they view themselves as having a potential to gain (survive in this case). In the second presentation, people with disease X tend to adopt a negative outlook based on a loss frame of reference; they may seek risk because they view themselves as having nothing to lose (likely to die in this case).

Narrow framing occurs when people evaluate the information to make a decision based on a *narrow frame* of reference. People lose sight of the big picture and focus on one or two specific points. For example, a consumer considering an automobile purchase might focus on style or design but overlook safety features, fuel economy, and reliability. FMPs may exhibit similar behaviors when choosing securities.

EXAMPLE 3

Effect of Framing

Decision-making frames are quite prevalent in the context of investor behavior. Risk tolerance questionnaires can demonstrate how framing bias may occur in practice and how FMPs should be aware of its effects.

Suppose an investor is to take a risk tolerance questionnaire for the purpose of determining which “risk category” he or she is in. The risk category will determine asset allocations and the appropriate types of investments. The following information is provided to each questionnaire taker:

Over a 10-year period, Portfolio ABC has averaged an annual return of 10 percent with an annual standard deviation of 16 percent. Assuming a normal return distribution, in a given year there is a 67 percent probability that the return will fall within one standard deviation of the mean, a 95 percent probability that the return will fall within two standard deviations of the mean, and a 99.7 percent probability that the return will fall within three standard deviations of the mean. Thus, there is a 67 percent chance that the return earned by Portfolio ABC will be between -6 percent and 26 percent, a 95 percent chance that the return will be between -22 percent and 42 percent, and a 99.7 percent chance that the return will be between -38 percent and 58 percent.

The following two questions focus on hypothetical Portfolio ABC, DEF, and XYZ. The risk and return for each portfolio is the same in each of the two questions, but the presentation of information differs. Will an investor choose the same portfolio or different portfolios when asked Question 1 compared to Question 2? Explain your answer.

- 1** Based on the chart below, which investment portfolio fits your risk tolerance and desire for long-term return?
 - A** Portfolio XYZ.
 - B** Portfolio DEF.
 - C** Portfolio ABC.

Portfolio	95% Probability Return Range	10-Year Average Return
XYZ	0.5% to 6.5%	3.5%
DEF	-18.0% to 30.0%	6.0%
ABC	-22.0% to 42.0%	10.0%

- 2** Based on the chart below, which investment portfolio fits your risk tolerance and desire for long-term return?
 - A** Portfolio XYZ.
 - B** Portfolio DEF.
 - C** Portfolio ABC.

Portfolio	10-Year Average Return	Standard Deviation of Returns
XYZ	3.5%	1.5%
DEF	6%	12%
ABC	10%	16%

Solution:

An investor may choose different portfolios when asked Question 1 compared to Question 2. Portfolio XYZ may appear more attractive in the first question, where two standard deviations are used to define the range of returns and show the risk, than in the second, where only the standard deviations are shown. Also in the second question, the returns are presented first and the measure of risk second. Thus, how questions are framed and the order in which questions are presented can have a significant impact on how they are answered. FMPs should be acutely aware of how framing can affect investment choices.

Consequences of Framing Bias FMPs' willingness to accept risk can be influenced by how situations are presented or framed. Similar to what we saw in the standard deviation example previously presented, a common framing problem occurs when investment questions are posed positively or negatively. For example, suppose Mrs. Ang has a choice of Portfolio A or Portfolio B, which are identical in terms of expected risk and return. Mrs. Ang is told that Portfolio A offers a 70 percent chance of attaining her financial goals, and Portfolio B offers a 30 percent chance of falling short of her financial goals. Mrs. Ang is likely to choose Portfolio A because of the positive way the question was framed.

As a result of framing bias, FMPs may do the following:

- Misidentify risk tolerances because of how questions about risk tolerance were framed; may become more risk-averse when presented with a gain frame of reference and more risk-seeking when presented with a loss frame of reference. This may result in suboptimal portfolios.
- Choose suboptimal investments, even with properly identified risk tolerances, based on how information about the specific investments is framed.
- Focus on short-term price fluctuations, which may result in excessive trading.

Detection of and Guidelines for Overcoming Framing Bias Framing bias is detected by asking such questions as, "Is the decision the result of focusing on a net gain or net loss position?" As discussed above, an investor who has framed the decision as a potential net loss is more likely to select a riskier investment; however, if the decision is framed as a potential net gain, the investor is more likely to go with a less risky investment. When making decisions, FMPs should try to eliminate any reference to gains and losses already incurred; instead, they should focus on the future prospects of an investment.

Regarding susceptibility to the positive and negative presentation of information, investors should try to be as neutral and open-minded as possible when interpreting investment-related situations. This approach can eliminate biased responses, help FMPs create better portfolios, and give FMPs a better chance of meeting long-term financial objectives.

3.2.4 Availability Bias

Availability bias is an information-processing bias in which people take a heuristic (sometimes called a rule of thumb or a mental shortcut) approach to estimating the probability of an outcome based on how easily the outcome comes to mind. Easily recalled outcomes are often perceived as being more likely than those that are harder to recall or understand. People often unconsciously assume that readily available thoughts, ideas, or images represent unbiased estimates of statistical probabilities. People decide the probability of an event by how easily they can recall a memory of the event. The basic problem is that there are biases in our memories. For instance, recent events are much more easily remembered and available.

There are various sources of availability bias. We will examine the four most applicable to FMPs: retrievability, categorization, narrow range of experience, and resonance. Each of these categories will be described, and then we will review examples of each as applied to FMPs.

Retrievability If an answer or idea comes to mind more quickly than another answer or idea, the first answer or idea will likely be chosen as correct even if it is not the reality. For example, Tversky and Kahneman (1973) performed an experiment in which subjects listened to a list of names and were then asked to judge if the list contained more men or women. In reality, the list contained more women than men, but the list of

men included famous names. As availability theory would predict, most of the subjects concluded that the list contained more men than women because they immediately recalled the names of the famous men.

Categorization When solving problems, people gather information from what they perceive as relevant search sets. Different problems require different search sets, which are often based on familiar categorizations. If it is difficult to come up with a search set, the estimated probability of an event may be biased. For example, if an American is asked to come up with a list of famous baseball players and a list of famous soccer players, the list of soccer players is likely to be quite short. This assignment might lead the American to erroneously conclude that there are fewer famous soccer players than baseball players.

Narrow Range of Experience This bias occurs when a person with a narrow range of experience uses too narrow a frame of reference based upon that experience when making an estimate. For example, assume that a CFA charterholder goes to work for a hedge fund. Because this person encounters other CFA charterholders every day at her own and other hedge funds, she is likely to overestimate the proportion of CFA charterholders who work for hedge funds. She is also likely to underestimate the proportion of CFA charterholders who work in other areas, such as private wealth management, because that is not within her frame of reference. In reality, a small percentage of CFA charterholders work for hedge funds.

Resonance People are often biased by how closely a situation parallels their own personal situation. For example, jazz music lovers are likely to overestimate how many people listen to jazz music. On the other hand, people who dislike jazz music are likely to overestimate the number of people who dislike jazz music.

Clearly, overlap exists between the sources of availability bias. For instance, a person's range of experience will affect his search sets, what information is retrieved, and what resonates with him. The critical aspect is not to be able to identify the specific source of bias, but rather to know the sources of bias in order to detect and overcome the availability bias. The questions to ask can be much more specific and helpful when based on the sources of availability bias rather than on the more general definition of availability bias.

Consequences of Availability Bias FMPs' investment choices may be influenced by how easily information is recalled. As a result of availability bias, FMPs may do the following:

- Choose an investment, investment adviser, or mutual fund based on advertising rather than on a thorough analysis of the options. For instance, when asked to name potential mutual fund companies to invest with, many people will name only the funds that do extensive advertising. In reality, many mutual fund companies do little or no advertising. The choice of mutual fund should be based on a variety of factors that make it a good fit given the investor's objectives and risk/return profile. Choices based on advertising are consistent with retrievability as a source of availability bias.
- Limit their investment opportunity set. This may be because they use familiar classification schemes. They may restrict investments to stocks and bonds of one country or may fail to consider alternative investments when appropriate.
- Fail to diversify. This may be because they make their choices based on a narrow range of experience. For example, an investor who works for a fast-growing company in a particular industry may overweight investments in that industry.
- Fail to achieve an appropriate asset allocation. This consequence may occur because they invest in companies that match their own personal likes and dislikes without properly taking into account risk and return.

Detection of and Guidelines for Overcoming Availability Bias To overcome availability bias, investors need to develop an appropriate investment policy strategy, carefully research and analyze investment decisions before making them, and focus on long-term results. A disciplined approach will prevent the investor from overemphasizing the most recent financial events based on easy recall. It will also help establish suitable asset allocations based on return objectives, risk tolerances, and constraints. It should also help assure that the portfolio of investments is adequately diversified and not affected by the availability bias from any source. FMPs need to recognize that it is a human tendency to overemphasize the most recent financial events because of easy recall.

When selecting stocks, it is crucial to consider your availability bias. Such questions as, “Did you hear about the stocks on Bloomberg, read about them in the *Wall Street Journal*, see them on CNBC, or receive a sell-side research report?” and “Am I buying or selling a group of investments because of some recent market event or trend without doing adequate analysis?” focus on retrievability. A valuable study done by Gadarowski (2001) found that stocks with the highest press coverage underperformed in the subsequent two years.

Such additional questions as, “How did you decide which investments to consider? Did you choose investments based on your familiarity with the industry or country?” and “Did you choose your investments because you like the companies’ products?” help identify issues of categorization, narrow range of experience, and resonance as sources of availability bias.

It is also important to realize that humans generally disregard or forget about events that happened more than a few years ago. For example, if you were in a car accident last week, it would be natural for you to drive more cautiously than you normally would for a period of time. However, as time passed, you would likely resume your normal driving behavior. Availability bias causes investors to *overreact* to market conditions, whether positive or negative. An excellent illustration is the technology bubble in the late 1990s. Investors got caught up in technology mania, causing them to disregard the risks. It is natural for people to be influenced by current events.

Another problem is that much of the information we receive is inaccurate, outdated, or confusing. The information may be based on opinions that are not based on sound analysis. Availability bias causes people to think that events that receive heavy media attention are more important than they may actually be. Many FMPs ignore the fact that they lack the training, experience, and objectivity to interpret the massive amount of investment information available.

3.3 Cognitive Errors: Conclusion

Cognitive errors are statistical, information-processing, or memory errors that result in faulty reasoning and analysis. The individual may be attempting to follow a rational decision-making process but fail to do so because of cognitive errors. For example, the person may fail to update probabilities correctly, properly weigh and consider information, or gather information. If these errors are drawn to the attention of an individual attempting to follow a rational decision-making process, he or she is likely to be receptive to correcting the errors.

Individuals are less likely to make cognitive errors if they remain vigilant to the possibility of their occurrence. A systematic process to describe problems and objectives; to gather, record, and synthesize information; to document decisions and the reasoning behind them; and to compare the actual outcomes with expected results will help reduce cognitive errors.

4

EMOTIONAL BIASES

We will now review six emotional biases, their implications for investment decision making, and suggestions for managing the effects of these biases. Although emotion has no single universally accepted definition, an emotion may be thought of as a mental state that arises spontaneously rather than through conscious effort. Emotions may be undesired to the individuals feeling them; although they may wish to control the emotion and their response to it, they often cannot. Emotional biases are harder to correct for than cognitive errors because they originate from impulse or intuition rather than conscious calculations. In the case of emotional biases, it may only be possible to recognize the bias and adapt to it rather than correct for it.

Emotional biases can cause investors to make suboptimal decisions. Because emotions are rarely identified and recorded in the decision-making process—they have to do with how people feel rather than what and how they think—fewer emotional biases have been identified. The six emotional biases discussed are loss aversion, overconfidence, self-control, status quo, endowment, and regret aversion. In the discussion of each of these biases, some related biases may also be discussed.

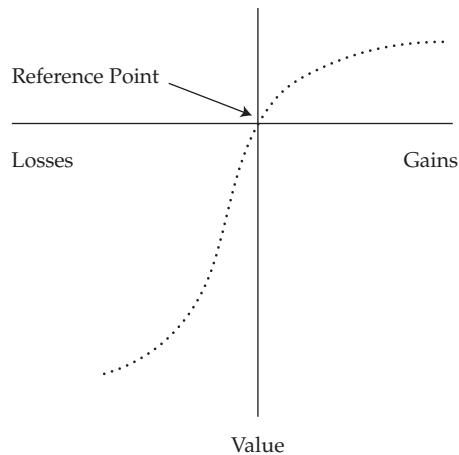
4.1 Loss-Aversion Bias

Loss-aversion bias was identified by Daniel Kahneman and Amos Tversky in 1979 while they were working on developing prospect theory.⁸ In prospect theory, loss-aversion bias is a bias in which people tend to strongly prefer avoiding losses as opposed to achieving gains. A number of studies on loss aversion suggest that, psychologically, losses are significantly more powerful than gains. When comparing absolute values, the utility derived from a gain is much lower than the utility given up with an equivalent loss.

Rational FMPs should accept more risk to increase gains, not to mitigate losses. However, paradoxically, FMPs tend to accept more risk to avoid losses than to achieve gains. Loss aversion leads people to hold their losers even if an investment has little or no chance of going back up. Similarly, loss-aversion bias leads to risk avoidance when people evaluate a potential gain. Given the possibility of giving back gains already realized, FMPs lock in profits, thus limiting their upside profits.

Kahneman and Tversky describe loss-averse investor behavior as the evaluation of gains and losses based on a reference point. A value function that passes through this reference point is seen in Exhibit 3. It is s-shaped and asymmetric, implying a greater impact of losses than of gains for the same variation in absolute value. This utility function implies risk-seeking behavior in the domain of losses (below the horizontal axis) and risk avoidance in the domain of gains (above the horizontal axis). An important concept embedded in this utility representation is what Shefrin and Statman (1985) coined the *disposition effect*: the holding (not selling) of investments that have experienced losses (losers) too long, and the selling (not holding) of investments that have experienced gains (winners) too quickly. The resulting portfolio may be riskier than the optimal portfolio based on the risk/return objectives of the investor.

⁸ Kahneman and Tversky (1979).

Exhibit 3 Value Function of Loss Aversion**EXAMPLE 4****Effect of Loss-Aversion Bias**

Loss-aversion bias, executed in practice as the *disposition effect*, is observed often by wealth management practitioners. The classic case of this bias is when an investor opens the monthly account statement and scans the individual investments for winners and losers. Seeing that some investments have lost money and others have gained, discuss how the investor is likely to respond given a loss-aversion bias.

Sample Solution:

The investor is likely to respond by continuing to hold the losing investments. The idea of actually losing money is so painful that the first reaction is to hold the investment until it breaks even. The investor is acting based on emotions, not cognitive reasoning. In this case, if the investor did some research, he or she might learn that the company in question is experiencing difficulty and that holding the investment actually adds to the risk in the portfolio (hence the term risk-seeking in the domain of losses).

Conversely, the winners are making money. Loss-averse FMPs have a tendency to sell these investments and realize their gains to avoid any further risk. In this case, if the investor did some research, he or she might learn that the company in question actually improves the risk/return profile of the portfolio. By selling the investment, not only is the potential for future losses eliminated, but the potential for future gains is also eliminated. Combining the added risk of holding the losers with the elimination of potential gains from selling the winners may make investors' portfolios less efficient than portfolios based on fundamental analysis.

Consequences of Loss Aversion As a result of loss-aversion bias, FMPs may do the following:

- Hold investments in a loss position longer than justified by fundamental analysis. FMPs hold losing investments in the hope that they will return to break even.
- Sell investments in a gain position earlier than justified by fundamental analysis. FMPs sell winning investments because they fear that their profit will erode.
- Limit the upside potential of a portfolio by selling winners and holding losers.
- Trade excessively as a result of selling winners. Excessive trading has been shown to lower investment returns.
- Hold riskier portfolios than is acceptable based on the risk/return objectives of the FMP. This is caused by the sale of investments that are winners and the retention of investments that are losers. FMPs may accept more risk in their portfolios than they would if they had based their decision on risk/return objectives and fundamental analysis.

Further, framing and loss-aversion biases may affect the FMP simultaneously, and is a potentially dangerous combination. When people have suffered losses, they may view risky alternatives as a source of opportunity; when people have gained, they may view choices involving additional risk as a threat. For example, an investor who has a net loss is more likely than average to choose the riskier investment, while a net gainer is more likely to go with a less risky alternative.⁹ A caveat to this basic principle is that once money is made through a profitable trade, some investors may view the profit differently from other money and decide to engage in additional risky behavior with it. Richard H. Thaler of the University of Chicago refers to this as the “house money effect,” which is based on the willingness of gamblers to engage in increasingly risky gambles with previous winnings. The gamblers view themselves as risking someone else’s money; in the case of the gambler, it is the casino or house’s money they view as at risk.¹⁰

Special Application: Myopic Loss Aversion As a possible explanation for the *equity premium puzzle*, a phenomenon that describes the anomalously higher historical real returns of stocks over government bonds, Benartzi and Thaler (1995) conceived *myopic loss aversion*. This combines aspects of time horizon-based framing, mental accounting, and loss-aversion biases. Investors presented with annual return data for stocks and bonds tend to adopt more conservative strategies (lower allocation to equities) than those presented with longer-term return data, such as 30-year compound returns. Investors place stocks and bonds into separate mental accounts rather than thinking of them together in a portfolio context; they seem to be more concerned with the potential for short-term losses than with planning for the relevant time horizon and focusing on long-term results. Benartzi and Thaler use the term *myopic loss aversion* in reference to this behavior. They argue that investors evaluate their portfolios on an annual basis and as a result overemphasize short-term gains and losses and weigh losses more heavily than gains. The overemphasis on short-term losses results in a higher than theoretically justified equity risk premium.

Paul A. Samuelson (1963) presented an example that is illustrative of myopic loss aversion (this was written before the term myopic loss aversion had been introduced). Samuelson offered a colleague the following bet: Flip a coin; if it comes up heads you

⁹ Depending on the incentive structure, an investment manager may be especially prone to this. In essence, having experienced losses, the investment manager may have nothing further to lose by choosing risky investments; or having experienced gains, the investment manager may be motivated to lock in those gains.

¹⁰ Thaler and Johnson (1990).

win \$200, and if it comes up tails you pay or lose \$100. The distribution of outcomes of this bet can be shown as $\{\$200, 0.50; -\$100, 0.50\}$. Samuelson reports that his colleague turned this bet down but said that he would be happy to take 100 such bets. Samuelson then proved that this pair of choices is irrational. That is, someone should not be willing to play a bet many times if he is not willing to play it just once. Of more interest is the explanation offered by the colleague for turning down the bet: "I won't bet because I would feel the \$100 loss more than the \$200 gain." This view is consistent with loss aversion. A simple utility function that would capture this notion is the following:

$$(1) U(x) = x, \text{ when } x \geq 0 \text{ and}$$

$$U(x) = 2.5x, \text{ when } x < 0,$$

where x is a change in wealth relative to the status quo.

With this loss-averse utility function, the utility of a single play of the gamble is negative (less than the status quo of not playing). The expected utility is $-25 [= 0.5(200) + 0.5(2.5(-100))]$. However, with two plays, you have a 25 percent chance of winning \$400, a 50 percent chance of winning \$100, and a 25 percent chance of losing \$200. The distribution of outcomes created by the portfolio of two bets $\{\$400, 0.25; \$100, 0.50; -\$200, 0.25\}$ yields a positive expected utility of $25 [= 0.25(400) + 0.5(100) + 0.25(2.5(-200))]$. Whether a decision maker accepts taking the gamble twice depends on mental accounting. A myopic decision maker will first determine whether he likes the prospect of the initial gamble in the series, will conclude that he does not, and consequently will reject the entire series. Samuelson's friend was evidently loss averse, but he was not myopic because he was willing to accept the series. He did not focus on the short term but considered the long term.

The argument developed by Benartzi and Thaler (1995) is that the price of financial assets reflects the preferences of FMPs who are both loss averse and myopic. To appreciate the effect of myopia on risk attitudes, consider an investor with the utility function defined above who must choose between a risky asset that pays an expected 7 percent per year with a standard deviation of 20 percent (like stocks) and a safe asset that pays a sure 1 percent per year. According to the logic we applied to Samuelson's colleague, the attractiveness of the risky asset depends on the time horizon of the investor. An investor who is prepared to wait a long time before evaluating the outcome of the investment as a gain or a loss will find the risky asset more attractive than another investor (equally loss averse, but more myopic), who expects to evaluate the outcome soon. Furthermore, FMPs who differ in the frequency with which they evaluate outcomes will not derive the same utility from owning stocks. The probability of observing a loss is higher when the frequency of evaluation is high. If losses cause more mental anguish than equivalent gains cause pleasure, the experienced utility associated with owning stocks is lower for the more myopic investor (Kahneman, Wakker, and Sarin, 1997). Over time, the myopic investor is expected to gravitate to a lower level of risk.

Detection of and Guidelines for Overcoming Loss Aversion A disciplined approach to investment based on fundamental analysis is a good way to alleviate the impact of the loss-aversion bias. It is impossible to make experiencing losses any less painful emotionally, but analyzing investments and realistically considering the probabilities of future losses and gains may help guide the FMP to a rational decision.

4.2 Overconfidence Bias

Overconfidence bias is a bias in which people demonstrate unwarranted faith in their own intuitive reasoning, judgments, and/or cognitive abilities. This overconfidence may be the result of overestimating knowledge levels, abilities, and access to information.

For example, people generally do a poor job of estimating probabilities; still, they believe they do it well because they believe that they are smarter and more informed than they actually are. This view is sometimes referred to as the *illusion of knowledge bias*. Overconfidence may be intensified when combined with *self-attribution bias*. Self-attribution bias is a bias in which people take credit for successes and assign responsibility for failures. In other words, success is attributed to the individual's skill, while failures are attributed to external factors. Illusion of knowledge and self-attribution biases contribute to the overconfidence bias.

Overconfidence bias has aspects of both cognitive and emotional errors but is classified as emotional because the bias is primarily the result of emotion. It is difficult to correct for because it is difficult for people to revise self-perceptions of their knowledge and abilities. The concept of overconfidence has been derived from a large number of psychological experiments and surveys in which subjects overestimate both their own predictive abilities as well as the precision of the information they have been given.

There are two basic types of overconfidence bias rooted in the illusion of knowledge: *prediction overconfidence* and *certainty overconfidence*. Both types have cognitive and emotional aspects; both types demonstrate faulty reasoning combined with "gut feel" and such emotional elements as hope. Hope frequently underpins the probabilities assumed when investment decisions are made in an overconfident state. When the FMP feels lucky and bases probabilities on that luck rather than on the actual likelihood of an event, the resulting financial decision is likely to generate results less than those expected by the FMP.

Prediction overconfidence occurs when the confidence intervals that FMPs assign to their investment predictions are too narrow. For example, when estimating the future value of a stock, overconfident FMPs will incorporate far too little variation—using a narrower range of expected payoffs and a lower standard deviation of returns—than justified based on historical results and fundamental analysis. As a result of underestimating risks, particularly downside risks, FMPs may hold poorly diversified portfolios.

Certainty overconfidence occurs when the probabilities that FMPs assign to outcomes are too high because they are too certain of their judgments. This certainty is often an emotional response rather than a cognitive evaluation. For example, having decided that a company is a good investment, people may become blind to the prospect of a loss and predict high returns with virtual certainty. When the results are less than expected, the FMPs are surprised and disappointed. In response, they are likely to sell the investment and look for a replacement that they feel is certain to generate high returns. People susceptible to certainty overconfidence often trade too frequently.

Self-attribution bias is the tendency of individuals to ascribe their successes to innate personal traits, such as talent or foresight, while blaming failures on exogenous factors, such as bad luck. It can be broken down into two subsidiary biases: *self-enhancing* and *self-protecting*. Self-enhancing bias describes people's propensity to claim too much credit for their successes. Self-protecting bias describes the denial of personal responsibility for failures. The need for self-esteem affects the attribution of task outcomes; people protect themselves psychologically as they attempt to comprehend their successes and failures.

EXAMPLE 5

Prediction and Certainty Overconfidence

Prediction Overconfidence:

Clarke and Statman (2000) demonstrated prediction overconfidence when they asked investors the following question: "In 1896, the Dow Jones Industrial Average, which is a price index that does not include dividend reinvestment,

was at 40. In 1998 it crossed 9,000. If dividends had been reinvested, what do you think the value of the DJIA would be in 1998? In addition to that guess, also predict a high and low range so that you feel 90 percent confident that your answer is between your high and low guesses." In the survey, few responses reasonably approximated the potential 1998 value of the Dow, and no one estimated a correct confidence interval. (The 1998 value of the DJIA, under the conditions posed in the survey, would have been 652,230!)

Certainty Overconfidence:

People display certainty overconfidence in everyday life situations, and that overconfidence carries over into the investment arena. People have too much confidence in the accuracy of their own judgments. As people learn more about a situation, the accuracy of their judgments may increase but their confidence may increase even more; as a result, they may fallaciously equate the quantity of information with its quality. Confidence also tends to increase if people are given incentives to perform. Overconfidence is greatest when accuracy is near chance levels, and reduces as accuracy increases from 50 percent to 80 percent. Slovic, Fischhoff, and Lichtenstein (1982) gave subjects a general knowledge test and then asked them how sure they were of their answer. Subjects reported being 100 percent sure when they were actually only 70 percent to 80 percent correct.

Consequences of Overconfidence Bias As a result of overconfidence bias, FMPs may do the following:

- Underestimate risks and overestimate expected returns.
- Hold poorly diversified portfolios.
- Trade excessively.
- Experience lower returns than those of the market.

Many overconfident FMPs claim above-average aptitude for selecting stocks, with little supporting evidence. Barber and Odean (2001) found that after trading costs and before taxes, the average investor underperformed the market by approximately 2 percent per year.

Barber and Odean also found that the average subject's annual portfolio turnover was 80 percent (slightly less than the 84 percent averaged by mutual funds). The least active quintile of participants, with an average annual turnover of 1 percent, earned 17.5 percent annual returns, outperforming the 16.9 percent garnered by the S&P during this period. The most active 20 percent of FMPs averaged a *monthly* turnover of over 9 percent, but they realized pre-tax returns of only 10 percent annually. The authors of the study do, indeed, seem justified in labeling frequent trading as hazardous.

Many overconfident FMPs also believe they can pick mutual funds that will deliver superior future performance. The market-trailing performance of the average mutual fund is proof that most mutual fund clients also fail in this endeavor. Worse yet, FMPs tend to trade in and out of mutual funds at the worst possible times, chasing returns with poor results, as we learned in the previously referenced DALBAR study.

Detection of and Guidelines for Overcoming Overconfidence Bias FMPs should review their trading records, identify the winners and losers, and calculate portfolio performance over at least two years. Investors with an unfounded belief in their own ability to identify good investments may recall winners and their results but underestimate the number and results of their losers. A conscious review process will force them to acknowledge their losers, because a review of trading activity will demonstrate not only the winners but also the losers. This review will also identify the amount of

trading. When FMPs engage in too much trading, they should be advised to keep track of every investment trade and then calculate returns. This exercise will demonstrate the detrimental effects of excessive trading. Because overconfidence is also a cognitive error, more complete information can often help FMPs understand the error of their ways.

It is critical that investors be objective when making and evaluating investment decisions. There is an old Wall Street adage, “Don’t confuse brains with a bull market,” that warns about self-attribution. It is advisable to view the reasoning behind and the results of investments, winning and losing, as objectively as possible. Unfortunately, most people have difficulty being objective about their own behavior. This can lead to self-attribution and overconfidence biases and result in repeating the same mistakes: overtrading and chasing returns to the detriment of actual realized returns.

To stay objective, it is a good idea to perform post-investment analysis on both successful and unsuccessful investments. When did you make money? When did you lose money? Mentally separate your good money-making decisions from your bad ones. Then, review the beneficial decisions and try to discern what, exactly, you did correctly. Did you purchase an investment at a particularly advantageous time based on fundamentals, or did you luck out by timing a market upswing? Similarly, review the decisions that you categorized as poor. Did you make an investment aptly based on fundamentals and then make an error when it came time to sell, or was the market going through a correction? When reviewing unprofitable decisions, look for patterns or common mistakes that perhaps you were unaware you were making. Note any such tendencies that you discover, and try to remain mindful of them by brainstorming a rule or reminder such as: “I will do X in the future” or “I will not do Y in the future.” Being conscious of these rules will help overcome any bad habits you may have acquired, and it can also reinforce your reliance on strategies that have served you well.

4.3 Self-Control Bias

Self-control bias is a bias in which people fail to act in pursuit of their long-term, overarching goals because of a lack of self-discipline. There is an inherent conflict between short-term satisfaction and achievement of some long-term goals. Money is an area in which people are notorious for displaying a lack of self-control, but it is not the only one. Attitudes toward weight loss, smoking, and studying provide other examples. A person who is 100 pounds overweight is told by a doctor that weight loss is essential to long-term good health. Despite this knowledge, the individual may fail to cut back on food consumption. The short-term satisfaction of eating conflicts with the long-term goal of good health. Similarly, smokers may continue to smoke even though they are aware of the long-term health risks involved. People pursuing the CFA charter may fail to study sufficiently because of short-term competing demands on their time. Rational behavior would suggest that people would do whatever was necessary to achieve their long-term goals—whether to stay healthy or become a CFA charterholder—but it often does not happen.

When it comes to money, people may know they need to save for retirement, but they often have difficulty sacrificing present consumption because of a lack of self-control. The apparent lack of self-control may also be a function of hyperbolic discounting. Hyperbolic discounting is the human tendency to prefer small payoffs now compared to larger payoffs in the future. Sacrifices in the present require much greater payoffs in the future; otherwise, people will not be willing to make current sacrifices. People seem to have temporal short-sightedness or temporal myopia, focusing on the present and discounting the future. They spend today rather than save for tomorrow. This behavior can lead to high short-term utility and disastrous long-term utility.

Consequences of Self-Control Bias As a result of self-control bias, FMPs may do the following:

- Save insufficiently for the future.

Upon realizing that their savings are insufficient, FMPs may do the following:

- Accept too much risk in their portfolios in an attempt to generate higher returns. In this attempt to make up for less than adequate savings, the capital base is put at risk.
- Cause asset allocation imbalance problems. For example, some FMPs prefer income-producing assets in order to have income to spend. This behavior can be hazardous to long-term wealth because income-producing assets may offer less total return potential, particularly when the income is not reinvested, which may inhibit a portfolio's ability to maintain spending power after inflation. Other FMPs may favor equities over bonds simply because they like to take risks. Asset allocations should be based upon a variety of factors, including level of risk tolerance, but they should not be entirely driven by risk tolerance.

Detection of and Guidelines for Overcoming Self-Control Bias People have a strong desire to consume today, which can be counterproductive to attaining long-term financial goals. FMPs should ensure that a proper investment plan is in place and should have a personal budget. Investing without planning is like building without a blueprint. Planning is the key to attaining long-term financial goals; plans need to be in writing, so that they can be reviewed regularly. Failing to plan is planning to fail. FMPs need to maintain a proper balance in asset allocations to attain their long-term financial goals. Adhering to a saving plan and an appropriate asset allocation strategy are critical to long-term financial success.

4.4 Status Quo Bias

Status quo bias, coined by Samuelson and Zeckhauser (1988), is an emotional bias in which people do nothing (i.e., maintain the "status quo") instead of making a change. People are generally more comfortable keeping things the same than with change and thus do not necessarily look for opportunities where change is beneficial. Given no apparent problem requiring a decision, the status quo is maintained. Further, if given a situation where one choice is the default choice, people will frequently let that choice stand rather than opting out of it and making another choice. Thus, the process in presenting choices can influence decisions. For example, companies that enroll employees in defined contribution pension plans but give the employees the ability to opt out of the plan have a much higher participation rate than companies where employees have to opt in to the plan.

Status quo bias is often discussed in tandem with endowment and regret-aversion biases (described later) because the outcome of the biases, maintaining existing positions, may be similar. However, the reasons for maintaining the existing positions differ among the biases. In the status quo bias, the positions are maintained largely because of inertia rather than conscious choice. In the endowment and regret-aversion biases, the positions are maintained because of conscious, but possibly incorrect, choices. When endowment bias exists, ownership imbues an investment with intangible value beyond the true value to the holder. Endowment bias creates a preference for no change or the status quo. With regard to regret aversion, an FMP presented with two investment choices may opt for the status quo rather than potentially experience the regret of selling shares that then went up in price. When status quo, endowment, and regret-aversion biases are combined, people will tend to strongly prefer that things stay as they are, even at some personal cost.

Consequences of Status Quo Bias As a result of status quo bias, FMPs may do the following:

- Unknowingly maintain portfolios with risk characteristics that are inappropriate for their circumstances.
- Fail to explore other opportunities.

Detection of and Guidelines for Overcoming Status Quo Bias Status quo bias may be exceptionally strong and difficult to overcome. Education is essential. FMPs should quantify the risk-reducing and return-enhancing advantages of diversification and proper asset allocation. For example, with a concentrated stock position, showing what can happen to overall wealth levels if the stock collapses may persuade an FMP to diversify.

4.5 Endowment Bias

Endowment bias is an emotional bias in which people value an asset more when they hold rights to it than when they do not. Endowment bias is inconsistent with standard economic theory, which asserts that the price a person is *willing to pay* for a good should equal the price at which that person would be *willing to sell* the same good. However, psychologists have found that when asked, people tend to state minimum selling prices for a good that exceed maximum purchase prices that they are willing to pay for the same good. Effectively, ownership “endows” the asset with added value. Endowment bias can affect attitudes toward items owned for long periods of time or can occur immediately when an item is acquired. Endowment bias may apply to inherited or purchased securities.

FMPs may irrationally hold on to securities they already own, which is particularly true regarding their inherited investments. For example, a child or grandchild may hold an outsized inherited stock position because of an emotional attachment, despite the risk of a sizable loss if the stock stumbles. These investors are often resistant to selling even in the face of poor prospects. Again using the example of an inheritance, an FMP may hold an inherited municipal bond portfolio because of an emotional attachment, when a more aggressive asset mix may be more appropriate.

Samuelson and Zeckhauser (1988) aptly illustrate investor susceptibility to endowment bias and the resulting status quo bias. They performed trials in which subjects were told that they had inherited a large sum from their uncle and had four portfolios in which they could invest the sum. The portfolios bore various risks and rates of return. A second trial was performed with a single difference: subjects were told that the uncle had already invested the sum in a moderate risk company (one of the portfolio options in the previous trial). Subjects were presented with the same four portfolio options as in the first trial. The first trial had no status quo; the alternatives were all new. In the second trial, however, the moderate risk company portfolio was the status quo. Subjects chose the moderate risk company portfolio more often when it was in the status quo position than when it was not. Similarly, outcomes occurred for the other options when they (and not the moderate risk company portfolio) held the role of the status quo. This is a classic case of endowment and status quo biases combining. Many wealth management practitioners have encountered clients who are reluctant to sell securities bequeathed by previous generations. Often in these situations, investors cite feelings of disloyalty associated with the prospect of selling inherited securities, general uncertainty in determining the right choice, and concerns with tax issues. Although the latter may be a rational concern, the tax implications are most likely not being considered rationally. Sometimes the appropriate action may be to pay taxes and alter the investment portfolio.

Consequences of Endowment Bias As is the case with status quo bias, endowment bias may lead FMPs to do the following:

- Fail to sell off certain assets and replace them with other assets.
- Maintain an inappropriate asset allocation. The portfolio may be inappropriate for investors' levels of risk tolerance and financial goals.
- Continue to hold classes of assets with which they are familiar. FMPs may believe they understand the characteristics of the investments they already own and may be reluctant to purchase assets with which they have less experience. Familiarity adds to owners' perceived value of a security.

Detection of and Guidelines for Overcoming Endowment Bias Inherited securities are often the cause of endowment bias. In the case of inherited investments, an FMP should ask such a question as, "If an equivalent sum to the value of the investments inherited had been received in cash, how would you invest the cash?" Often, the answer is into a very different investment portfolio than the one inherited. It may also be useful to explore the deceased's intent in owning the investment and bequeathing it. "Was the primary intent to leave the specific investment portfolio because it was perceived to be a suitable investment based on fundamental analysis, or was it to leave financial resources to benefit the heirs?" Heirs who affirm the latter conclusion are receptive to considering alternative asset allocations.

When financial goals are in jeopardy, emotional attachment must be moderated; it cannot be accepted and adapted to. Several good resources are available on "emotional intelligence." FMPs should familiarize themselves with the topic so they can help themselves or their clients work through emotional attachment issues.

An effective way to address a desire for familiarity, when that desire contradicts good financial sense, is to review the historical performance and risk of the unfamiliar securities in question and contemplate the reasoning underlying the recommendation. Rather than replacing all familiar holdings with new, intimidating ones, start with a small purchase of the unfamiliar investments until a comfort level with them is achieved.

4.6 Regret-Aversion Bias

Regret-aversion bias is an emotional bias in which people tend to avoid making decisions that will result in action out of fear that the decision will turn out poorly. Simply put, people try to avoid the pain of regret associated with bad decisions. This tendency is especially prevalent in investment decision making. Regret aversion can cause FMPs to hold onto positions too long. They are reluctant to sell because they fear that the position will increase in value and then they will regret having sold it.

Regret aversion can also keep FMPs out of a market that has recently generated sharp losses or gains. Having experienced losses, our instincts tell us that to continue investing is not prudent. Yet periods of depressed prices may present great buying opportunities. Regret aversion can persuade us to stay out of the stock market just when the time is right for investing. On the upside, fear of getting in at the high point can restrict new investments from taking place.

Regret bias can have two dimensions: actions that people take and actions that people *could have* taken. More formally, regret from an action taken is called an *error of commission*, whereas regret from an action not taken is called an *error of omission*. Regret may be distinguished from disappointment in that regret includes strong feelings of responsibility for the choice that has been made. Regret is more intense when the unfavorable outcomes are the result of an error of commission versus an error of omission. Thus, no action becomes the preferred decision.

Koenig (1999) argues that regret aversion can initiate herding behavior. Regret aversion causes FMPs to avoid the pain of regret resulting from a poor investment decision, whether the loss comes from an investment that goes down or a “loss” resulting from a stock that went up that they did not own. It is not just the financial loss they regret; it is also the feeling of responsibility for the decision that gave rise to the loss. In order to avoid the burden of responsibility, regret aversion can encourage FMPs to invest in a similar fashion and in the same stocks as others. This herding behavior alleviates some of the burden of responsibility. As John Maynard Keynes (1936) writes in Chapter 12, “Worldly wisdom teaches that it is better for reputation to fail conventionally than to succeed unconventionally.”

Consequences of Regret-Aversion Bias As a result of regret-aversion bias, FMPs may do the following:

- Be too conservative in their investment choices as a result of poor outcomes on risky investments in the past. FMPs may wish to avoid the regret of making another bad investment and decide that low-risk instruments are better. This behavior can lead to long-term underperformance and potential failure to reach investment goals.
- Engage in herding behavior. FMPs may feel safer in popular investments in order to limit potential future regret. It seems safe to be with the crowd, and a reduction in potential emotional pain is perceived. Regret aversion may lead to preference for stocks of well-known companies even in the face of equal risk and return expectations. Choosing the stocks of less familiar companies is perceived as riskier and involves more personal responsibility and greater potential for regret.

Detection of and Guidelines for Overcoming Regret-Aversion Bias In overcoming regret-aversion bias, education is essential. FMPs should quantify the risk-reducing and return-enhancing advantages of diversification and proper asset allocation. Regret aversion can cause some FMPs to invest too conservatively or too riskily depending on the current trends. With proper diversification, FMPs will accept the appropriate level of risk in their portfolios depending, of course, on return objectives. To prevent investments from being too conservative, FMPs must recognize that losses happen to everyone and keep in mind the long-term benefits of including risky assets in portfolios. Recognizing that bubbles happen and keeping in mind long-term objectives will prevent a client from making investments that are too risky. Efficient frontier research can be quite helpful as an educational tool. Investing too conservatively or too riskily can potentially inhibit the ability to reach long-term financial goals.

4.7 Emotional Biases: Conclusion

Emotional biases stem from impulse, intuition, and feelings and may result in personal and unreasoned decisions. When possible, focusing on cognitive aspects of the biases may be more effective than trying to alter an emotional response. Also, educating about the investment decision-making process and portfolio theory can be helpful in moving the decision making from an emotional basis to a cognitive basis. When biases are emotional in nature, drawing these to the attention of an individual making the decision is unlikely to lead to positive outcomes; the individual is likely to become defensive rather than receptive to considering alternatives. Thinking of the appropriate questions to ask to potentially alter the decision-making process is likely to be most effective.

Such questions as, “If an equivalent sum to the value of the investments inherited had been received in cash, how would you invest the cash?” or “Was the primary intent to leave the specific investment portfolio because it was perceived to be a suitable investment based on fundamental analysis, or was it to leave financial resources to benefit the heirs?” are unlikely to elicit defensiveness. These types of questions are likely to open the way to a more rational investment approach.

INVESTMENT POLICY AND ASSET ALLOCATION

5

Behavioral biases can and should be accounted for by investors and their advisers in the investment policy development and asset allocation selection process. Behavioral finance considerations may have their own place in the constraints section of the investment policy statement along with liquidity, time horizon, taxes, legal and regulatory environment, and unique circumstances. Responses to such questions as the following may help develop the behavioral finance considerations that have an impact on investment decisions and the resulting portfolio.

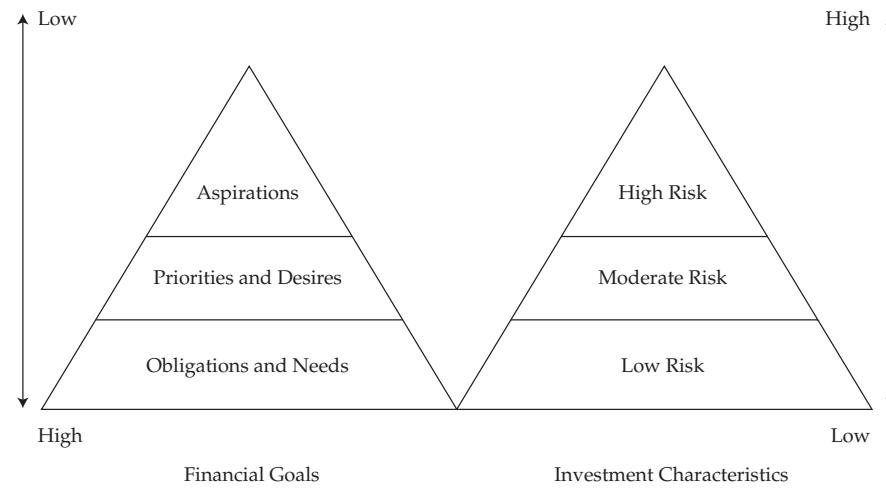
- 1 Which biases does the client show evidence of?
- 2 Which bias type dominates (cognitive or emotional)?
- 3 What effect do the client’s biases have on the asset allocation decision?
- 4 What adjustment should be made to a “rational” (risk tolerance-based) asset allocation that can account for the client’s behavioral make-up?
 - A When should behavior be *moderated* to counteract the potentially negative effects of these biases on the investment decision-making process?
 - B When should asset allocations be created that *adapt* to the investor’s behavioral biases so the investor can comfortably abide by his or her asset allocation decisions?
 - C When is it appropriate to design a *behaviorally modified asset allocation* (referred to as a modified portfolio, for convenience) for an investor?
 - D Once the decision is made to recommend a modified portfolio, what quantitative parameters should be used when putting the recommendation into action?

At the end of this section, we will review two case studies to help demonstrate these concepts. A variety of approaches exist to incorporate behavioral finance considerations into an investment policy statement and portfolio—including the use of a goals-based investing approach that is consistent with loss aversion (prospect theory) and mental accounting. Goals-based investing involves identifying an investor’s specific goals and the risk tolerance associated with each goal. Investments are chosen considering each goal individually. Thus, a portfolio is constructed in layers rather than using the holistic approach to portfolio construction of modern portfolio theory (MPT). In goals-based investing, a portfolio is evaluated in terms of attaining financial goals and risk management focuses on the size and likelihood of potential losses. Investors are assumed to be loss averse, not risk averse.

Investment portfolios are managed and updated based on changing circumstances and goals of the client. This approach may be attractive to investors who are more focused on wealth preservation (i.e., minimizing losses) than on wealth accumulation (i.e., maximizing returns). This approach can also be useful in highlighting the consequences of selecting an asset allocation that is riskier than is appropriate for the investor. Taking a goals-based investment approach to asset allocation is helpful in terms of keeping financial goals in mind and understanding how much risk can be

taken when creating a portfolio. Exhibit 4 illustrates a goals-based investing approach. Such an approach matches many investors' natural desire to put money in separate mental accounts and to focus on loss as a measure of risk.

Exhibit 4 Goals-Based Investing Approach



Financial advisers using this approach will typically first get their clients to consider their obligations and needs. The advisers will then estimate how much should be invested in low-risk (capital preservation) assets to meet those needs and obligations. Next, riskier assets are considered to attain priorities and desires. Finally, even riskier assets are added to meet aspirational goals. Typically, investors will end up having a diversified portfolio using this approach, but the resulting portfolio may not be efficient from a traditional finance perspective. The lack of efficiency is because the components of the portfolio are individually justified rather than based on modern portfolio theory that considers correlations between investments. However, risk may be better understood by the investor using this methodology. As a result, investors may find it easier to adhere to investment decisions and portfolio allocations made using this approach.

In the following sections, we will discuss the use of another approach that begins with the rational portfolio and makes modifications to accommodate behavioral finance considerations. The concept of *behaviorally modified asset allocation* is introduced, and guidelines for creating such an allocation are discussed.

5.1 Behaviorally Modified Asset Allocation

When designing a standard asset allocation program, an investor, often working with an adviser, will typically answer a risk tolerance questionnaire, document financial goals and constraints, and then adopt the output of a portfolio optimization model that matches the investor's risk tolerance category and accomplishes the investor's financial goals. In the case of institutional investors, they will consider these items from the perspective of the entity they are acting on behalf of. An investment adviser will consider these items from the perspective of their clients when developing investment policy statements and asset allocations. The output of the portfolio optimization model will be referred to as a "rational" portfolio allocation.

The process described above takes into account risk tolerance and financial goals but fails to take into account behavioral biases. For example, in response to major short-term market movements, some investors, individual and institutional, may

change their asset allocations to the detriment of the long-term investment plan. This behavior may be the result of a bias, such as the regret-aversion bias, that may lead to herding behavior or simply loss aversion. An investor's interest may be better served by the adoption of an asset allocation that suits the investor's natural psychological preferences—and it may not be one that maximizes expected return for a given level of risk. For example, one investor's behaviorally modified asset allocation (modified portfolio) may be a modest, lower-returning, long-term investment program compared to the rational portfolio allocation. This modified asset allocation is one to which the investor can comfortably adhere. Another investor with similar natural psychological tendencies may be persuaded of the merits of taking on more risk and as a result have a riskier modified portfolio. In both cases, the investor must be comfortable with the modified portfolio.

In creating a modified portfolio, it is critical to distinguish between emotional and cognitive biases and to consider the level of wealth of the investor in question. Individual biases should primarily be assessed for the purpose of identifying which type of biases dominate (cognitive or emotional) and what actions should be taken in response to observed behaviors while considering the investor's overall wealth level. The basic actions are to adapt to a bias or to moderate the impact of the bias. When a bias is adapted to, it is accepted and decisions are made that recognize and adjust for the bias rather than making an attempt to reduce the impact of the bias. The resulting portfolio represents an alteration of the rational portfolio; the alteration responds to the investor's biases while considering financial goals and level of wealth. To moderate the impact of a bias is to recognize the bias and to attempt to reduce or even eliminate the bias within the individual rather than to accept the bias. The resulting portfolio is similar to the rational portfolio, and a program is adopted to reduce or eliminate the investor's biases.

The next section will examine guidelines for determining a modified portfolio, including an explanation of how to assess wealth level. The perspective taken in the next section is that of a private wealth manager working with an individual client. The approach can be used with modification in other situations.

5.1.1 Guidelines for Determining a Behaviorally Modified Asset Allocation

Pompian and Longo (2005) offer two guidelines for helping a private wealth manager identify a behaviorally modified asset allocation for a client.

Guideline I	The decision to moderate or adapt to a client's behavioral biases during the asset allocation process depends fundamentally on the client's level of wealth. Specifically, the wealthier the client, the more the practitioner should adapt to the client's behavioral biases. The less wealthy, the more the practitioner should moderate a client's biases.
Rationale	A client's outliving his or her assets constitutes a far graver investment failure than a client's inability to accumulate wealth. The likelihood of a client outliving his or her assets is a function of the level of wealth. If a bias is likely to endanger a client's standard of living, moderating is an appropriate course of action. If a bias will only jeopardize the client's standard of living if a highly unlikely event occurs, adapting may be more appropriate. However, the potential impact of low-probability, high-impact events should be discussed with the client.

(continued)

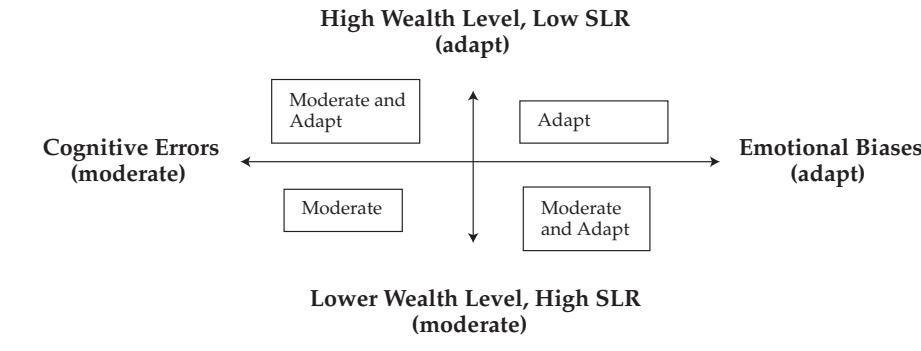
Guideline II The decision to moderate or adapt to a client's behavioral biases during the asset allocation process depends fundamentally on the type of behavioral bias the client exhibits. Specifically, clients exhibiting cognitive errors should be moderated, and those exhibiting emotional biases should be adapted to.

Rationale Because cognitive errors stem from faulty reasoning, better information and advice can often correct them. Conversely, emotional biases originate from feelings or intuition rather than conscious reasoning, and thus they are more difficult to correct.

Naturally, the determination of high wealth level and low wealth level is a subjective one that must be determined by the adviser in concert with the client. In this context, wealth is determined in relation to lifestyle, not just based on the level of assets. Some people have high levels of assets but also have an extravagant financial lifestyle to match, implying a "low" level of wealth; in other words, some people have a lot of assets but also spend accordingly. This behavior is related to *standard of living risk*. Standard of living risk (SLR) is the risk that the current or a specified acceptable lifestyle may not be sustainable. For example, individuals with modest assets and modest lifestyles that they do not wish to alter may not have a standard of living risk; as such, they might be viewed as having a moderate to high level of wealth. On the other hand, individuals with a high level of assets and extravagant lifestyles that they wish to maintain may have a standard of living risk; these individuals, regardless of level of assets, might be viewed as having a low to moderate level of wealth.

Guidelines I and II may, for some clients, yield a blended recommendation. For instance, a less wealthy client with strong emotional biases should be both adapted to and moderated. Exhibit 5 illustrates when to moderate and when to adapt.

Exhibit 5 Visual Depiction of Guideline I and Guideline II



5.1.2 How Much to Moderate or Adapt

A key concept in creating a behaviorally modified asset allocation is to decide how much it should deviate from the "rational" allocation of traditional finance. Exhibit 6 offers useful guidelines for helping to determine how much to adjust an allocation for behavioral bias.

Exhibit 6 Deviations from a “Rational” Portfolio

	Bias Type: Cognitive	Bias Type: Emotional
High Wealth Level/Low SLR	Modest Asset Allocation Change Suggestion: ± 5 to 10% Max Per Asset Class	Stronger Asset Allocation Change Suggestion: ± 10 to 15% Max Per Asset Class
Low Wealth Level/High SLR	Close to the Rational Asset Allocation Suggestion: ± 0 to 3% Max Per Asset Class	Modest Asset Allocation Change Suggestion: ± 5 to 10% Max Per Asset Class

Note that the percentages listed in the chart are *suggested* percentage adjustments from the “rational” allocation to asset classes based on behavioral bias. In terms of the magnitude of the suggested changes, to some these ranges may appear too narrow or too small in absolute terms, while others may see them as reasonable. The amount of change appropriate to modify an allocation will in large part depend on the number of asset classes used in the allocation. A 5 percent change in 10 asset classes, for example, could yield a substantial tilt to or away from risky assets; however, for an asset allocation with 4 asset classes, 5 percent would not be enough.

It is important to recognize the *relative* differences between these cases. The case requiring the least adjustment to the rational portfolio is a low wealth level client with cognitive bias. Here, the low wealth investor needs to modify his or her behavior to reach his or her financial goals, and with appropriate education and information, he or she should be able to adjust behavior to match the rational allocation. If an adjustment is needed, a ± 0 to 2 percent maximum asset class adjustment is suggested. We will see an example of this case in the case studies later. The case that will likely require the most adjustment per asset class is emotional bias at high wealth level. Here, a ± 10 percent maximum adjustment per asset class is suggested. The rationale for such a potentially high adjustment is that a wealthy investor with emotional bias may need substantial flexibility because emotional biases are difficult to correct; a high wealth level permits flexibility. The “middle of the road” cases are the high wealth level with cognitive biases and the low wealth level with emotional biases. With these two cases, a suggested maximum asset class adjustment is ± 5 percent. The rationale for this adjustment is that there is a need to both adapt to and moderate behavioral biases, and the offsetting that takes place likely requires a modest adjustment. Naturally these are only conceptual guidelines; actual client situations will likely require additional customization.

Through the following case studies, we will identify an investor’s behaviorally modified asset allocation. Thus equipped, investors and their advisers can more effectively apply behavioral finance research to investing activities. Institutional investors and money managers are not immune to behavioral biases. They should be particularly wary of cognitive errors. They should attempt to accept their knowledge limits and avoid belief perseverance and information-processing errors. Overconfidence is an emotional bias to which they may be particularly susceptible.

As discussed earlier, designing a standard asset allocation program with a client involves the following steps: 1) Advisers first administer a risk tolerance questionnaire; 2) Advisers discuss the client’s financial goals and constraints; 3) Advisers typically recommend the output of a mean–variance optimization from any number of financial planning software programs. This approach may work better for institutional and individual investors who are familiar with financial theory, but institutional and individual investors and investment advisers, along with other financial market participants, are all susceptible to behavioral biases.

In a scenario familiar to investment advisers, in response to short-term market movements, a client may request that his or her asset allocation be changed—to the detriment of the long-term investment plan. Kahneman and Riepe (1998) describe financial advising as “a prescriptive activity whose main objective should be to guide investors to make decisions that serve their best interest.” Serving the best interest of the client may be the recommendation of an asset allocation that suits the client’s natural psychological preferences; it may not be the rational asset allocation (one that maximizes expected return for a given level of risk). More simply, a client’s most appropriate behaviorally modified portfolio may be the long-term allocation recommendation that the client can comfortably adhere to. Conversely, another client’s recommended portfolio may be one that goes against his or her natural psychological tendencies, but the client may be well served to accept more risk than he or she might otherwise be comfortable with in order to attain a higher return for that level of risk. Note here that allocation recommendations do not necessarily need to be inefficient; they can still be on the efficient frontier. They can move up or down it based on the client’s behavioral make-up. However, even if the portfolio is on the efficient frontier, it may be inefficient considering transaction costs and the financial objectives of the investor.

5.2 Case Studies

The following case studies involve two hypothetical investors, Mr. Renaldo and Mrs. Maradona, and their adviser, Mr. Bobby Moore. Considering two dimensions, level of wealth and type of dominant biases, these case studies will consider two extreme examples: an investor with high wealth and emotional biases (Mr. Renaldo) and an investor with lower wealth and cognitive biases (Mrs. Maradona). Because of space constraints, we will not be able to review the two other extreme examples: an investor with high wealth and cognitive biases and an investor with lower wealth and emotional biases. Still, readers should understand that these cases will likely fall in between the two cases presented here in terms of behavioral adjustments to “rational” portfolio allocations.

These case studies were designed to answer four key questions in determining an investor’s modified portfolio.

- 1 Which biases does the client show evidence of?
- 2 What effect do the client’s biases have on the asset allocation decision?
- 3 What action should Mr. Moore take: moderate or adapt to these biases?
- 4 What is the appropriate behaviorally modified asset allocation for each client?

In the real world of investing, each client and each adviser is different; therefore, these case studies illustrate an approach to diagnosing and devising strategies for behaviorally biased clients rather than specific strategies. In each case, put yourself in the role of the adviser, Mr. Bobby Moore, and consider how you (Moore) should deal with the client and the given situation and approach the issues presented. The case studies will contain the following format, which is a simulation of the approach that advisers might encounter with a client:

- Introductory description of the case
- Identification of behavioral finance biases
- Effect of biases on asset allocation decision
- Action to be taken in response to identified biases (moderate or adapt)
- Recommendation of the behaviorally modified asset allocation

These cases involve hypothetical investors and are not intended to represent all investor types. Each client is unique and will differ from the clients described in these case studies. What is important is to follow the process that is being described on how to identify biases, how to determine what the appropriate course of action is for dealing with the biases, and how to adjust or not adjust the rational mean–variance portfolio recommendation for biased behavior.

Capital Markets Assumptions: For each of the case studies, assume that for the last three years, the stock market has experienced moderate and steady increases and interest rates have been stable. For simplicity, we will assume that the investors in the case studies will be limited to investing in three asset classes: stocks, bonds, and cash. Diagnosis for biases is done in two steps in the following way. First, a basic questionnaire (Exhibit 7) is given that assesses the 15 biases presented in this reading per the following list. *Note that the choice of responses would normally be in a multiple choice format, but in the interest of length, only the questions are shown here.* The questions do not follow the order of presentation of biases in the reading but instead intersperse emotional, belief perseverance, and information-processing biases. The question order can be altered, but it is advisable to not cluster questions about similar types of biases. Second, after reviewing the responses, the adviser focuses on biases identified by the questionnaire and delves further into them with the client to help create a modified portfolio.

Exhibit 7 Basic Diagnostic Questions for Behavioral Bias

Behavioral Bias	Diagnostic Question
Loss Aversion	Imagine you make an investment that drops 25 percent in the first six months. You are unsure if it will come back. What would you normally do (NOT what you <i>think</i> you should do; what you <i>would</i> do)?
Endowment	How would you describe your emotional attachment to possessions or investment holdings?
Status Quo	How would you describe the frequency of your trading?
Anchoring	You purchase a stock at \$50 per share. It goes up to \$60 in a few months, and then it drops to \$40 a few months later. You are uncertain what will happen next. How would you respond to this scenario?
Mental Accounting	Generally, do you categorize your money by different financial goals, or do you look at the bigger financial picture?
Regret Aversion	Have you ever made an investment that you have regretted making? How did that affect your future investing decisions?
Hindsight	Do you believe investment outcomes are generally predictable or unpredictable?
Framing	Assume you have agreed to a financial plan created by your adviser that has a projected return of 9 percent and an annual standard deviation of $+/-15\%$ (a typical plan). Would it surprise you to know that statistically in the worst case, the plan's return could be negative 36 percent or more in one year out of 100? Would this information cause you to rethink your risk tolerance?
Conservatism	Assume you make an investment based on your own research. An adviser presents you with information that contradicts your belief about this investment. How would you respond?
Availability	Do you ever make investment decisions (such as selecting a mutual fund or online broker) based on word-of-mouth or name recognition?
Representativeness	Have you ever made a new investment because of its apparent similarity to a past successful investment (e.g., a tech stock or value stock) without doing research to validate the new investment's merits?

(continued)

Exhibit 7 (Continued)

Behavioral Bias	Diagnostic Question
Overconfidence	Suppose you make a winning investment. How do you generally attribute the success of your decision?
Confirmation	Suppose you make an investment based on your own research. The investment doesn't move up as much as you thought it might. How are you likely to respond?
Illusion of Control	You are offered two free lottery tickets. You may either select your own numbers or have a machine do it. What would you do?
Self-Control	Do you tend to save or spend disposable income?

5.2.1 Case Study #1: Mr. Renaldo (High Wealth Level, Emotional Biases)

Mr. Renaldo ("Mr. R") is a single, 58-year-old, hard-working, international corporate lawyer (an employee of a large multinational company). He earns a salary of £600,000 annually. He has residences in both London and New York and generally lives within his annual income net of taxes. He occasionally spends more than his net income, but in other years he saves and invests. His current portfolio is worth approximately £3,500,000. It reached this value primarily because of some successful high risk oil and technology investments as well as stock options granted by his employer. Mr. R has no plans for marriage or children. He had a mild heart attack last year, but he has made a full recovery. His primary financial goal is to retire comfortably at age 65 with a reduced spending level of £150,000 and to bequeath any assets remaining at his death to his alma mater, Oxford University. Mr. R's financial adviser, Mr. Bobby Moore, has been working with Mr. R for less than a year. During that time, Moore has proposed a comprehensive financial plan. Despite Moore's recommendations, however, Mr. R's asset allocation has remained the same at nearly 80 percent equities, with 40 percent in his employing company's publicly traded stock. Still, Moore has developed a good working relationship with Mr. R.

Moore believes that Mr. R. is a well-grounded, fairly rational person, but he also believes that Mr. R has some behavioral issues to address. In Moore's view, the most important issue is that Mr. R has not taken action yet on the new, more conservative allocation that Moore proposed months ago of 60 percent stocks, 30 percent bonds, and 10 percent cash. Moore worries about the lack of diversification in Mr. R's portfolio. Moore's concern is that a severe downward market fluctuation or drop in Mr. R's employing company's stock may cause him to sell assets irrationally, affecting his long-term financial plan. Moore's financial plan demonstrates that even with a somewhat less aggressive portfolio, Mr. R could still meet his primary financial objectives if he could save just £25,000 annually. Moore believes that one of the issues is that Mr. R thinks of himself as a very savvy investor because of some risky bets that worked out well for him in the past. Moore suspects that Mr. R hasn't changed his allocation because he thinks Moore's allocation recommendation is too conservative. Moore also notices that Mr. R constantly worries about missing out on hot stocks that go up because he was not aggressive enough. Moore decides that the appropriate course of action is to ask Mr. R to take a behavioral bias diagnostic questionnaire. When Moore gets the answers to the questionnaire, he decides to delve further into three biases: *regret aversion, overconfidence, and self-control*. Moore asks Mr. R further questions on these three biases. Exhibit 8 shows Mr. R's answers to these questions in **bold**.

Exhibit 8 Mr. Renaldo's Bias Diagnostic Tests**Regret-Aversion Diagnostic Test****Question 1:**

Suppose you make an investment in Stock ABC, and over the next six months, ABC appreciates by your target of 15 percent. You contemplate selling but then come across an item in the *Financial Times* that rehashes the company's recent successes and also sparks new optimism. You wonder whether ABC could climb even higher. Which answer describes your likeliest response given ABC's recent performance and the FT article?

- A I think I'll hold off and wait to see what happens. I'd really "kick" myself if I sold now and ABC continued to go up.**
- B I'll probably sell because ABC has hit the target I set, and I try to stick to the targets I set.**

Question 2:

Suppose you have decided to invest £10,000 in one individual company stock, and you have narrowed your choice down to two companies: Blue, Inc., and Red, Inc. Blue is a well-followed, eminently established company whose shareholders include many large pension funds. Red is newer but has performed well; it has not garnered the same kind of public profile as Blue, and it has few well-known investors. According to your calculations, both stocks are expected to have equal risk and return payoffs. Which answer most closely matches your thought process in this situation?

- A I would probably feel indifferent between the two investments, because both generated the same expected parameters with respect to risk and return.**
- B I will most likely invest in Blue because if I invested in Red and my investment failed, I would feel foolish. Few well-known investors backed Red, and I would really regret going against their informed consensus only to discover that I was wrong.**
- C I will most likely invest in Blue because I feel safe taking the same course as so many respected institutional investors. If Blue does decline in value, I know I won't be the only one caught by surprise. With so many savvy professionals sharing my predicament, I could hardly blame myself for poor judgment.**

Scoring Guidelines:

People answering A in Question 1 and/or B or C in Question 2 may harbor susceptibility to regret-aversion bias.

Overconfidence Bias Diagnostic**Question 1:**

How easy do you think it was to predict the collapse of the housing market in the United States in 2007–2008?

- A Easy.**
- B Somewhat easy.**
- C Somewhat difficult.**
- D Difficult.**

(continued)

Exhibit 8 (Continued)**Question 2:**

Assume that from 1926 through 2006, the compound annual return for equities was 10 percent. In any given year, what returns do you expect your equity investments to produce?

- A Below 10 percent.
- B About 10 percent.
- C Above 10 percent.
- D **Well above 10 percent.**

Question 3:

How much ability do you believe you have in picking investments that will outperform the market?

- A Absolutely no ability.
- B Little if any ability.
- C Some ability.
- D **A fair amount of ability.**

Scoring Guidelines:

Answering A or B in Question 1, answering C or D in Question 2, or answering C or D in Question 3 indicates susceptibility to overconfidence bias.

Self-Control Bias Diagnostic**Question 1:**

Suppose that you are in need of a new automobile. You have been driving your current car for seven years, and it's time for a change. Which of the following approaches are you most likely to take?

- A I would typically "under spend" on a car because I view a car as transportation and I don't need anything fancy. Besides, I can save the extra money I might have spent on a fancy car and put it away in my savings accounts.
- B I would typically purchase a medium-priced model, with some fancy options, simply because I enjoy a nice car. I may forego other purchases in order to afford a nice car. I would not purchase anything extravagant, but a nice car is something that I value to an extent and am willing to spend money to obtain.
- C **When it comes to cars, I like to indulge myself. I'd probably splurge on a top-of-the-line model and select most or all available luxury options. Even if I must purchase this car at the expense of saving money, for the long term, I believe that it's vital to "live in the moment." This car is simply my way of living in the moment.**

Question 2:

How would you characterize your retirement savings patterns?

- A I consult my advisers and make sure that every tax-favored investment vehicle is "maxed out" (e.g., 401(k), IRA), and I will often save additional funds in taxable accounts.

Exhibit 8 (Continued)

- B** I will usually take advantage of most tax-favored investment vehicles, though in some cases I'm sure that details may have escaped my attention. I may or may not save something in taxable investment accounts.
- C** I hardly ever save for retirement. I spend most of my disposable income, so very little remains available for savings.

Scoring Guidelines:

People answering B or C to Questions 1 or 2 may be susceptible to self-control bias. Lack of self-control is very common.

Through this process, Moore finds that Mr. R is indeed susceptible to the following emotional biases:

- **Regret-aversion bias** (the tendency to avoid making a decision for fear the decision may cause regret later).
- **Overconfidence bias** (the tendency to overestimate one's investment savvy).
- **Self-control bias** (the tendency to spend today rather than save for tomorrow).

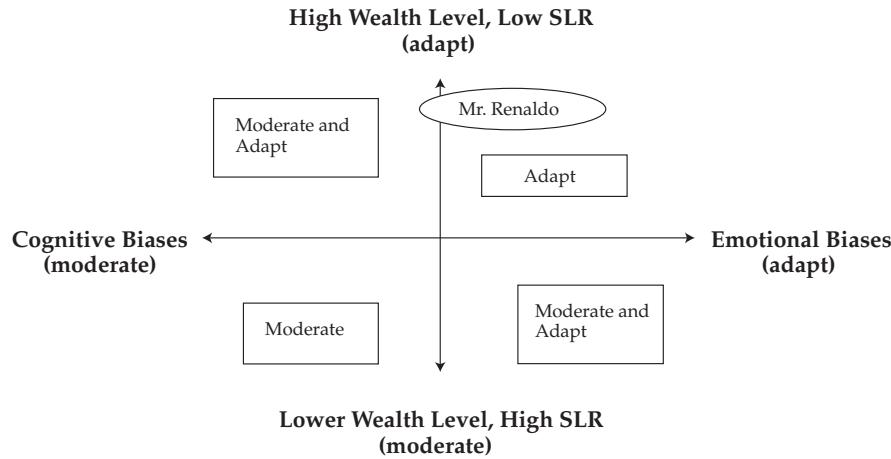
As part of the original financial planning process, Moore administered a risk tolerance questionnaire to Mr. R for the purpose of generating a mean–variance optimization portfolio recommendation. When Moore generated the optimization recommendation, Mr. R's proposed asset allocation was 60 percent stocks, 30 percent bonds, and 10 percent cash. Moore's job is now to answer the following three questions:

- What effect do Mr. R's biases have on the asset allocation decision?
- Should Moore moderate or adapt to Mr. R's biases?
- What is an appropriate behaviorally modified asset allocation for Mr. R?

Solutions to Mr. Renaldo Case Study

Effect of Biases Mr. Renaldo has emotional biases that provide a clear indication of what allocation he would naturally prefer, which is one dominated by equities. Mr. Renaldo's overconfidence leads him to be more comfortable with equities than may be appropriate. This overconfidence, as well as a potential endowment bias, may explain why he has chosen to hold a substantial part of his portfolio in his employing company's stock. Additionally, Mr. R is likely to experience regret if he misses a major market move. On the other hand, he has a high need for current income that supplements his "spend today" mentality (self-control bias), and he may need the "ballast" of fixed-income investments in the event of a market downturn. Because his level of wealth is high, however, he does have some flexibility with his allocation to favor equity over fixed income.

Moderate or Adapt? When considering level of wealth, Mr. Renaldo clearly does not run a "standard of living" risk, which argues for adapting to his biases. Additionally, his behavioral biases are principally emotional (overconfidence, regret aversion, self-control). Given these facts, and given that he naturally prefers an allocation favoring equity, Moore now has the information with which to make the following graph and the "moderate, adapt, or both moderate *and* adapt" recommendation.

Exhibit 9 Illustration of Mr. Renaldo's Case Study Information


Moore decides that the appropriate recommendation is to *adapt* to Mr. R's biases and create a more aggressive portfolio that Mr. R can adhere to and be comfortable with. Moore also recommends that Mr. R reduce his company stock position by 50 percent and reduce spending, if possible. At the same time, Moore will run a cash flow analysis to ensure that in the event of a market downturn, Mr. R's living expenses will not be at risk. Moore also advises a comfortable cash reserve.

Behaviorally Modified Portfolio Decision The mean–variance optimizer's recommended allocation was **60 percent stocks, 30 percent bonds, and 10 percent cash**. Using guidelines presented earlier in the reading for emotional biases at a high wealth level, in Moore's judgment, an appropriate behaviorally modified asset allocation is an allocation of **70 percent stocks, 20 percent bonds, and 10 percent cash**. When Moore checks his financial planning software to make sure that this allocation will statistically ensure that Mr. R will have adequate living expenses in the event of a market downturn, it shows that the behaviorally modified asset allocation indeed works. Thus, Moore recommends this allocation to Mr. R, explaining how he arrived at that particular allocation recommendation.

5.2.2 Case Study #2: Mrs. Maradona (Lower Wealth Level, Cognitive Biases)

Mrs. Maradona ("Mrs. M") is a 75-year-old widow from the United States with a modest lifestyle and no income beyond what her investment portfolio of \$1,500,000 generates (about \$90,000 per year) and a small government pension of \$10,000 annually. Her adviser, Mr. Bobby Moore, has known Mrs. M for about five years. Although Mrs. M did not clearly articulate her investment goals when Moore first started working with her, over time Moore has learned that Mrs. M's primary investment goals are 1) to not lose money and 2) to maintain the purchasing power of her assets after fees and taxes. Her desire to not lose money stems from the fact that she recalls that her parents lost money in the US market crash of 1929; she has a "Depression Era" mentality. One of her tendencies is to spread her money around many different banks, and she speaks regularly about various "pots" of money—such as one for generating her income, one for her grandson's education, and one for paying her bills. Moore has been challenged by the fact that Mrs. M is quite stubborn in her opinions and rarely, if ever, listens to Moore when he recommends that she change her way of thinking about her investment money and portfolio allocation. Her knowledge of financial concepts is limited, but she is willing to meet regularly and discuss issues with Moore over tea.

Moore is concerned that she is too conservative in her approach and will not accomplish one of her key goals, keeping her purchasing power, because she only invests in government bonds and cash. By taking this approach, her portfolio will not keep up with her spending after inflation and taxes in the long run; therefore, she is putting herself at risk to outlive her assets. As Moore reflects one day on his relationship with Mrs. M, he realizes that the only recommendation she has accepted is to buy investment-grade corporate bonds to slightly increase her returns. Moore suspects that behavioral biases are influencing Mrs. M and not permitting her to feel comfortable with changing her portfolio. Moore asks her if she will take a 15-question assessment to examine her investor personality. She agrees. Based on the answers to the assessment, Moore decides to delve further into three biases: *anchoring, mental accounting, and loss aversion*. Moore provides Mrs. M with additional questions on these three biases. Exhibit 10 shows Mrs. M's answers in **bold**.

Exhibit 10 Mrs. Maradona's Bias Diagnostic Tests

Anchoring Bias Diagnostic

Question 1:

Suppose you own a five-bedroom house and have decided it is time to “down-size” to a smaller house. You are not in a rush to sell your house, but taxes and general expenses on your home are significant and you want to sell it as soon as possible. Your real estate agent, who you have known for many years and trust, lists your home for sale at \$500,000. You only paid \$125,000 for the house 10 years ago, so you are thrilled. The house has been on the market for several months, and you have not had any serious offers. One day, you get a phone call from your agent saying he needs to come over right away. When he arrives, he tells you that Books-Direct, a major employer in town, just declared bankruptcy and 1,000 people are out of work. He has been in meetings all week with his colleagues, and they estimate that real estate prices are down about 10 percent across all types of homes in your area. He says that you must decide at what price you now want to list your home based on this new information. You tell him that you will think it over and get back to him shortly. Please select one of the following that would be your answer:

- A You decide to keep your home on the market for \$500,000.
- B You decide to lower your price by 5 percent to \$475,000.**
- C You decide to lower your price by 10 percent to \$450,000.
- D You decide to lower your price to \$425,000 because you want to be sure you get a bid on the house.

Scoring Guidelines:

Mrs. M chose B, and thus she may be susceptible to anchoring bias. It is clear that if she wants to sell her home, she should lower her price by 10 percent. Mrs. M demonstrates that she is “anchored” to \$500,000 and will not fully adjust to the updated information.

Mental Accounting Bias Diagnostic Test

Question 1:

How do you tend to think about your money?

- A I tend to think about my money as one “pot,” and money is spent out of that one pot.

(continued)

Exhibit 10 (Continued)

- B I tend to segregate my money into various accounts, such as money for paying bills, money for traveling, and money for bequeaths.**
- C I tend to segregate my money based on its source, such as pension, interest income, or capital gains.**

Scoring Guidelines:

Mrs. M selected B. People who select B or C may be susceptible to mental accounting bias.

Loss-Aversion Diagnostic Test**Question 1:**

Suppose you are presented with the following investment choices. Please choose between the following two outcomes:

- A An assured gain of \$400.**
- B A 25 percent chance of gaining \$2,000 and a 75 percent chance of gaining nothing.**

Question 2:

You are then asked to choose between the following two outcomes:

- A An assured loss of \$400.**
- B A 50 percent chance of losing \$1,000, and a 50 percent chance of losing nothing.**

Scoring Guidelines**Question 1:**

Loss-averse investors are likely to opt for the assurance of a profit in A, even though the expected value of B is \$500.

Question 2:

Loss-averse investors are more likely to select B even though the expected value in B is -\$500 and the loss in A is only \$400.

By making both these choices, Mrs. M appears to exhibit loss aversion.

Moore's suspicions are confirmed. Mrs. M is subject to the following biases:

- **Loss-aversion bias** (the tendency to feel the pain of losses more acutely than the pleasure of gains).
- **Anchoring and adjustment bias** (the tendency to believe that current market levels are "right"; up or down directional estimates are made from the current level).
- **Mental accounting bias** (the tendency to segregate money into different "accounts.")

As part of the original asset allocation process, Moore also administered a risk tolerance questionnaire to Mrs. M for the purpose of generating a mean-variance optimization portfolio recommendation. When Moore generated the optimization recommendation, Mrs. Maradona's "rational" asset allocation was 70 percent bonds, 20 percent stocks, and 10 percent cash; her actual allocation is 100 percent bonds.

Moore is convinced that Mrs. M needs to have a riskier portfolio than the one she currently has and that the reason she is invested so conservatively is primarily because of behavioral biases. Moore's job is now to answer the following three questions:

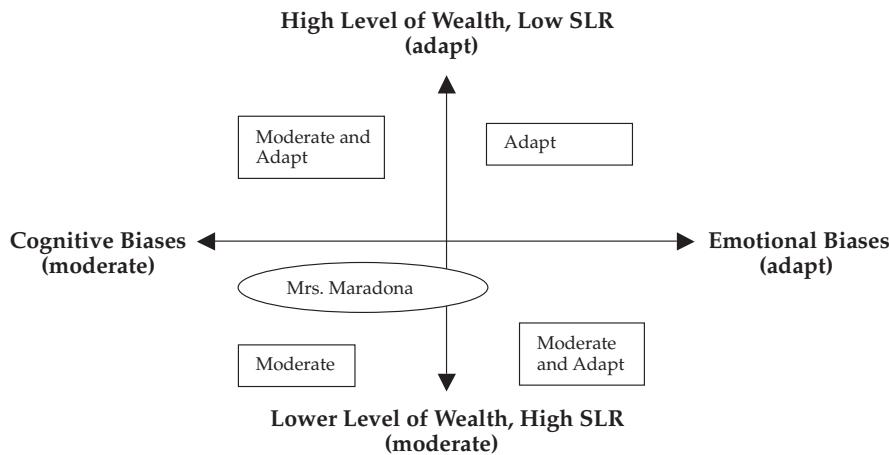
- What effect do Mrs. M's biases have on the asset allocation decision?
- Should Moore moderate or adapt to Mrs. M's biases?
- What is an appropriate behaviorally modified asset allocation for Mrs. M?

Solutions to Mrs. Maradona Case Study

Effect of Biases Mrs. Maradona's biases are consistent and demonstrate to Moore a clear allocation preference for bonds. Because Mrs. Maradona does not want to put her principal at risk (which is manifested by loss-aversion bias) and separates her money into mental accounts (mental accounting), she would naturally prefer the safe and secure asset allocation of 100 percent bonds that she now has. Additionally, because the stock market rises and falls regularly, she will likely make irrational conclusions about what the "right" level of the overall stock market should be (anchoring bias); as a result, she will be wary of any exposure to equities. Thus, if Moore as her adviser presented her with an allocation of 100 percent bonds, she would be likely to immediately agree with that recommendation. However, Moore understands that she has a bias toward such an allocation.

Moderate or Adapt? Mrs. Maradona's level of wealth—which, while not low, is not high—puts her at a relatively high standard of living risk (SLR). If Moore *adapts* to her biases and recommends an allocation of 100 percent bonds, Moore's financial planning software tells him that Mrs. Maradona runs the risk of outliving her assets, a clearly unacceptable outcome. Moore needs to help her understand that she would be at risk if she accepted a 100 percent bond portfolio. Because her biases are principally cognitive (mental accounting, anchoring), and these types of biases can be corrected with education and advice, Moore is confident he can help her make changes. Moore now has the information needed to make the following table.

Exhibit 11 Illustration of Mrs. Maradona's Case Study Information



Behaviorally Modified Portfolio Decision Moore decides that an appropriate course of action is to *moderate* Mrs. M's bias preferences, so he recommends that she accept some risk in her portfolio. Moore reasons that an appropriate moderation of Mrs. M's biases will result in the "rational" allocation of **70 percent bonds, 20 percent equity, and 10 percent cash** (the mean–variance recommendation). Moore checks his financial planning software to make sure that this allocation will statistically ensure that Mrs. M will not outlive her money. The software shows that this allocation is acceptable. Moore explains to Mrs. M how an allocation based on her biases may have led to an allocation such that her resources would have likely been depleted before her death. Thus, Moore recommends the **70 percent bonds, 20 percent equity, and 10 percent cash** allocation to Mrs. M. Also, Moore will continue a program of investor education on the risk of outliving one's assets.

SUMMARY

Behavioral biases potentially affect the behaviors and decisions of financial market participants. By understanding behavioral biases, financial market participants may be able to moderate or adapt to the biases and as a result improve upon economic outcomes. These biases may be categorized as either cognitive errors or emotional biases. The type of bias influences whether the impact of the bias is moderated or adapted to.

Among the points made in this reading are the following:

- Individuals do not necessarily act rationally and consider all available information in the decision-making process because they may be influenced by behavioral biases.
- Biases may lead to sub-optimal decisions.
- Behavioral biases may be categorized as either cognitive errors or emotional biases. A single bias may, however, have aspects of both with one type of bias dominating.
- Cognitive errors stem from basic statistical, information-processing, or memory errors; cognitive errors typically result from faulty reasoning.
- Emotional biases stem from impulse or intuition; emotional biases tend to result from reasoning influenced by feelings.
- Cognitive errors are more easily corrected for because they stem from faulty reasoning rather than an emotional predisposition.
- Emotional biases are harder to correct for because they are based on feelings, which can be difficult to change.
- To adapt to a bias is to recognize and accept the bias and to adjust for the bias rather than to attempt to moderate the bias.
- To moderate a bias is to recognize the bias and to attempt to reduce or even eliminate the bias within the individual.
- Cognitive errors can be further classified into two categories: belief perseverance biases and information-processing biases.
- Belief perseverance errors reflect an inclination to maintain beliefs. The belief is maintained by committing statistical, information-processing, or memory errors. Belief perseverance biases are closely related to the psychological concept of cognitive dissonance.

- Belief perseverance biases include conservatism, confirmation, representativeness, illusion of control, and hindsight.
- Information-processing biases result in information being processed and used illogically or irrationally.
- Information-processing biases include anchoring and adjustment, mental accounting, framing, and availability.
- Emotional biases include loss aversion, overconfidence, self-control, status quo, endowment, and regret aversion.
- Understanding and detecting biases is the first step in overcoming the effect of biases on financial decisions. By understanding behavioral biases, financial market participants may be able to moderate or adapt to the biases and as a result improve upon economic outcomes.

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PRACTICE PROBLEMS

The following information relates to Questions 1–5

Luca Gerber recently became the chief investment officer for the Ludwigs Family Charity, a mid-size private foundation in Switzerland. Prior to assuming this role, Gerber was a well-known health care industry analyst. The Ludwigs' family fortune is primarily the result of entrepreneurship. Gerhard Ludwigs founded ABC Innovations (ABC), a biotech company dedicated to small cell lung cancer research. The foundation's portfolio is fifteen percent invested in ABC.

Gerber initially feels that fifteen percent investment in ABC is high. However, upon review, he decides it is appropriate based on Ludwigs' involvement and their past success with similar ventures. Gerber makes a mental note to himself to closely monitor the investment in ABC because he is not familiar with small-cap startup companies. The remaining 85 percent of the foundation's portfolio is invested in equity of high quality large-cap pharmaceutical companies. Gerber deems this allocation appropriate and is excited that he is able to continue to use his superior knowledge of the health care industry.

For the past two years, ABC has been dedicated to Project M, an effort directed at developing a drug for the treatment of relapses in small cell lung cancer. Project M has delayed its Phase Two trials twice. Published results from Phase One trials have raised some concerns regarding the drug. In its last two quarterly investors' conference calls, ABC's CEO was very cautious in discussing expectations for Project M. ABC's stock price decreased by over 20 percent during the past six months. Gerber believes that the research setbacks are temporary because of ABC's past success with projects. He expects that ABC will begin Phase Two within a year, and also believes that once Project M goes into Phase Two, ABC's stock price should reach a new 52-week high of CHF 80.

Soon after deciding to hold the stock, Gerber reads an article by ABC's chief scientist in which certain scientific results from Project M are detailed. As a conclusion, the article states: "Although we still have some major obstacles to overcome, the Project M team has seen positive signs that a treatment for small cell lung cancer is achievable." While Gerber has difficulty interpreting the scientific results, he feels reassured after reading the concluding statement.

Today, ABC announces the news that it will no longer pursue Project M, citing early signs of failure of the project. As a result of the announcement, the stock price drops by 50 percent. Gerber is stunned. He reviews the company's history and notes that ABC has been up front about its struggles to solve the Project M issues. Gerber now realizes that he has been ignoring all the signs and feels a tremendous regret for not having sold the foundation's investment in ABC earlier.

- 1 **Discuss** how Gerber displayed availability bias with *one* example. **Determine** the implications of availability bias for financial decision making and **describe** *one* way Gerber could overcome the bias.
- 2 **Discuss** how Gerber displayed overconfidence bias and **cite** *one* example to support this statement. **Distinguish** between the availability bias and the overconfidence bias.

- 3 **Discuss** how Gerber displayed conservatism bias. **Cite** three examples from the reading.
- 4 **Determine** whether Gerber displayed confirmation bias when reviewing the chief scientist's article. **Justify** your answer with one reason.

Answer Question 4 in the template provided below:

Determine whether Gerber displayed confirmation bias when reviewing the chief scientist's article. (circle one)	Justify your answer with one reason.
---	---

Agree

Disagree

-
- 5 **Indicate** which bias is illustrated by Gerber's focus on the achievement of a 52-week high of CHF 80. **Discuss** how Gerber could have mitigated its impact.
-

The following information relates to Questions 6–12

Tiffany Jordan is a hedge fund manager with a history of outstanding performance. For the past 10 years, Jordan's fund has used an equity market neutral strategy (long/short strategy that strives to eliminate market risk; i.e., beta should be zero) which has proved to be effective as a result of Jordan's hard work. An equity market neutral strategy normally generates large daily trading volume and shifts in individual security positions. Jordan's reputation has grown over the years as her fund has consistently beaten its benchmark. Employee turnover on Jordan's team has been high; she has a tendency to be quick to blame, and rarely gives credit to team members for success. During the past twelve months, her fund has been significantly underperforming against its benchmark.

One of Jordan's junior analysts, Jeremy Tang, is concerned about the underperformance and notes the following:

- Observation 1 Certain positions are significantly under water, have much higher risk profiles, and have been held for much longer than normal.
- Observation 2 The trading volume of the fund has decreased by more than 40 percent during the past year.
- Observation 3 The portfolio is more concentrated in a few sectors than in the past.

Tang is worried that the portfolio may be in violation of the fund's Investment Policy Statement (IPS). Tang brings this to Jordan's attention during a regular weekly team meeting. Jordan dismisses Tang's analysis and tells the team not to worry because she knows what she is doing. Jordan indicates that since she believes the pricing misalignment will correct itself, the portfolio will not be able to take advantage of the reversion to the mean if she sells certain losing positions. She reassures the team that this strategy has performed well in the past and that the markets will revert and the fund's returns will return to normal levels.

Tang tactfully suggests that the team review the fund's IPS together, and Jordan interrupts him and reminds the team that she has memorized the IPS by heart. Tang contemplates his next step. He is concerned that Jordan is displaying behavioral biases which are affecting the fund's performance.

- 6 By taking credit for successes but assigning blame for failures, Jordan is *most likely* demonstrating:
 - A loss-aversion bias.
 - B self-attribution bias.
 - C illusion of knowledge bias.
 - 7 Which of Tang's observations is *least likely* to be the consequence of Jordan demonstrating loss-aversion bias?
 - A Observation 1.
 - B Observation 2.
 - C Observation 3.
 - 8 Which of Jordan's actions *least* supports that she may be affected by the illusion of control bias?
 - A Her dismissal of Tang's analysis.
 - B Her routine of holding weekly team meetings.
 - C Her comment on market turnaround and current holdings.
 - 9 How does Jordan *most likely* demonstrate loss-aversion bias?
 - A Telling the team not to worry.
 - B Reducing the portfolio turnover this year.
 - C Deciding to hold the losing positions until they turn around.
 - 10 Which of the following emotional biases has Jordan *most likely* exhibited?
 - A Endowment.
 - B Regret aversion.
 - C Overconfidence.
 - 11 Which one of the following biases did Jordan *not* demonstrate?
 - A Self-attribution.
 - B Representativeness.
 - C Illusion of knowledge.
 - 12 Which of Tang's findings is *not* a typical consequence of self-control bias?
 - A Failure to explore other portfolio opportunities.
 - B Asset allocation imbalance problems in the portfolio.
 - C A higher risk profile in the portfolio due to pursuit of higher returns.
-

SOLUTIONS

1 Availability bias, a cognitive error, is an information-processing bias. Individuals exhibiting this bias will assess the likelihood of an outcome based on how easily they can recall the information. Gerber exhibits this bias in two ways:

- Although Gerber felt the foundation's investment in ABC was high, he decided that Ludwigs' involvement and their past success justified the investment in ABC. The information on the past success of Ludwigs' investments came easily to mind.
- Gerber believed 100 percent of the foundation's portfolio in the health care industry was appropriate, most likely because of his past experience as an analyst in the industry. It is easier for Gerber to recall information from his past than to develop a diversified investment portfolio. Investors who exhibit availability bias may limit their investment opportunity set, may choose an investment without doing a thorough analysis of the stock, may fail to diversify, and may not achieve an appropriate asset allocation. Gerber exhibits all of these tendencies when he is evaluating the foundation's portfolio.

The implications of this bias lead the portfolio to be undiversified, and as a result, the portfolio holds assets that may not be appropriate. Gerber is only investing in pharmaceutical companies. The following is a summary of issues with the foundation's portfolio:

- No thorough analysis regarding investment in ABC.
- A limited investment opportunity set; invested only in the health care sector.
- An undiversified portfolio.
- An inappropriate asset allocation; invested only in equity.

Gerber could overcome this bias by developing an appropriate investment policy strategy, with a focus on appropriate goals (short- and long-term), and having a disciplined approach to investment decision making. An investment policy statement would help provide discipline and would alert Gerber and his team that he really has only considered investments that he is familiar with. Further, Gerber and his investment team should consider the asset allocation within the portfolio.

2 Gerber displayed overconfidence bias by having too much faith in his "superior knowledge of the health care industry." Overconfidence bias and the related illusion of knowledge bias result when individuals overestimate their knowledge levels and abilities. Overconfidence bias has aspects of both cognitive and emotional errors but is classified as emotional because the emotional aspect dominates. Emotional biases, which stem from impulse or intuition, may be considered to result from reasoning influenced by feelings. These biases are difficult to correct.

Overconfidence is primarily an emotional bias and is thus different from availability bias which is an information-processing bias and a cognitive error. Cognitive errors result from faulty reasoning and analysis. The individual may be attempting to follow a rational decision-making process but fails to do so because of cognitive errors. Gerber perceives the foundation's investment allocation and stock selection as appropriate, and does not process all of the information available to him. He notes that ABC should be monitored closely because of the fact he is not familiar with startup companies; however, he does

not process information that goes beyond his knowledge base to see that the investment itself is problematic. Although the overconfidence and availability biases are clearly related, Gerber can make better investment decisions by focusing on the cognitive error aspects of his behavior. Cognitive biases are easier to correct for than emotional biases, which are based on how people feel.

- 3** Conservatism bias, a cognitive error, is a belief perseverance bias in which people maintain their prior views or forecasts by inadequately incorporating new information. This cognitive error has aspects of both statistical and information-processing errors. Gerber displayed conservatism bias by maintaining his prior views on ABC without adequately incorporating new information. There are several examples of new information that was either ignored or inadequately considered:
- the delays in initiation of Phase Two trials;
 - the discouraging results from Phase One;
 - the cautionary language from the CEO; and
 - the chief scientist's statement indicating that there were "major obstacles to overcome."

Gerber disregarded all the negative news and cautionary language that was released by ABC. Gerber failed to incorporate the new information into his analysis of ABC. The impact was a loss to the foundation, which could have been reduced had Gerber incorporated the information into his analysis and adjusted the foundation's holdings of ABC.

4

Determine whether Gerber displayed confirmation bias when reviewing the chief scientist's article.
(circle one)

Justify your answer
with one reason.

Agree

Confirmation bias, a cognitive error, is a belief perseverance bias. Individuals who exhibit this bias look for confirmation of their belief and ignore any information which contradicts their belief. Gerber displayed confirmation bias by selectively placing more weight on the portion of the statement "the Project M team has seen positive signs that treatment for small cell lung cancer is achievable" in the article, even though the positive results mentioned in the article appeared to be a general statement. Gerber ignored the comment on the major obstacles which the team had encountered because it was contrary to his belief in Project M.

Disagree

- 5** Gerber demonstrated anchoring bias by placing high hope in ABC stock reaching a new 52-week high of CHF 80. Anchoring is an information-processing bias which influences the way people estimate probabilities. When required to estimate a value with unknown magnitude, people generally begin by envisioning some initial default number—an "anchor"—which they then adjust up or down to reflect subsequent information and analysis. Despite setbacks and new information, Gerber did not adjust his view of CHF 80, but continued to

cling to this anchor or belief even after reviewing the chief scientist's report. He perceived new information through a warped lens; thus, the decision making deviated from rational reasoning.

To overcome anchoring bias, Gerber should consciously ask questions that may reveal an anchoring and adjustment bias: "Am I holding on to this stock based on rational analysis, or am I trying to attain a price that I am anchored to, such as the purchase price or a high water mark?" He should look at the basis for his decision to hold ABC to determine if it is anchored to a price target (a new 52-week high) or based on an objective, rational view of the company's fundamentals. Gerber should have periodically reviewed his decision-making process to determine if his analysis of ABC's prospects was appropriate, focusing more on the company's fundamentals rather than the price target.

- 6 B is correct. Self-attribution is a bias in which people take credit for successes and assign responsibilities for failure. Jordan attributes successful decisions to herself while poor decisions are attributed to the team. Her self-esteem affects how she looks at success and failure. Self-attribution and illusion of knowledge biases contribute to overconfidence bias, which Jordan clearly demonstrates later when she tells the team that she knows what she is doing.
- 7 C is correct. Loss aversion by itself may cause a sector concentration; however, a market neutral strategy tends to focus on individual stocks without regard to the sector. The sector exposure would be mitigated with the balancing of the individual long and short positions.
- 8 B is correct. Holding weekly team meetings, which would indicate a willingness to listen to feedback from others, is not representative of the illusion of control bias. The illusion of control bias is one in which people believe they can control outcomes. Individuals exhibiting this bias display great certainty in their predictions of outcomes of chance events and ignore others' viewpoints. Jordan is sure that the market will turn around even though it is out of her control. She chooses not to listen to Tang who is questioning her viewpoint.
- 9 C is correct. Jordan's behavior is a classic example of loss aversion: When a loss occurs, she holds on to these positions longer than warranted. By doing so, Jordan has accepted more risk in the portfolio. Loss-aversion bias is one in which people exhibit a strong preference to avoid losses versus achieving gains. One of the consequences of loss aversion bias is that the financial management professional (in this case, Jordan) may hold losing investments in the hope that they will return to break-even or better.
- 10 C is correct. Jordan exhibits overconfidence in several ways. She ignores the analysis done by Tang. This may be because Jordan believes she is smarter and more informed than her team members, which is typical of an individual with an illusion of knowledge bias. The certainty she demonstrates that the market will revert is evidence of overconfidence. Her overconfidence is intensified by her self-attribution bias, which is demonstrated through her dealings with her team when she blames them for losses while taking credit for the gains. Finally, her portfolio's underperformance against the benchmark is a consequence of overconfidence bias.
- 11 B is correct. Nowhere in the scenario did it mention that Jordan classified certain information into a personalized category. Representativeness bias is a cognitive bias in which people tend to classify new information based on past

experiences and classifications. Jordan is not relating the certainty about the future or her decision to hold losing positions back to something she has done or experienced in the past.

- 12** A is correct. Failing to explore other opportunities is a demonstration of status quo bias, not self-control. Self-control bias occurs when individuals deviate from their long-term goals, in this case, the investment policy statement, due to a lack of self-discipline. Jordan is not adhering to the strategy which has been successful in the past. The consequences of self-control bias include accepting too much risk in the portfolio (C) and asset allocation imbalance problems (B) as Jordan attempts to generate higher returns.

READING

9

Behavioral Finance and Investment Processes

by Michael M. Pompian, CFA, Colin McLean, MBA, FIA, FSIP, and Alistair Byrne, PhD, CFA

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LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. explain the uses and limitations of classifying investors into personality types;
<input type="checkbox"/>	b. discuss how behavioral factors affect adviser-client interactions;
<input type="checkbox"/>	c. discuss how behavioral factors influence portfolio construction;
<input type="checkbox"/>	d. explain how behavioral finance can be applied to the process of portfolio construction;
<input type="checkbox"/>	e. discuss how behavioral factors affect analyst forecasts and recommend remedial actions for analyst biases;
<input type="checkbox"/>	f. discuss how behavioral factors affect investment committee decision making and recommend techniques for mitigating their effects;
<input type="checkbox"/>	g. describe how behavioral biases of investors can lead to market characteristics that may not be explained by traditional finance.

INTRODUCTION

1

Much of current economic and financial theory is based on the assumptions that individuals act rationally and consider all available information in the decision-making process.¹ Behavioral finance challenges these assumptions. The relaxing of these assumptions has implications at both the individual and market levels. It is

¹ Investors are assumed to be rational; investors make decisions consistent with utility theory and revise expectations (update beliefs) consistent with Bayes' formula. They are further assumed to be self-interested and risk-averse, to have access to perfect information, and to process all available information.

important to note that, at the individual level, all market participants, whether they are less knowledgeable individual investors or experienced money managers, may act irrationally; in other words, all market participants may deviate from the behavior that is assumed in traditional financial theory. Some of these deviations have been identified and categorized as behavioral biases. In addition, individual behavioral biases may be reinforced in a group setting, which further complicates rational investment processes.

This reading focuses on understanding individual investor behavior and how it affects adviser-client relationships and portfolio construction, as well as on the analyst-, committee-, and market-level impact of behavioral biases. Section 2 discusses how investors may be classified by type based on the biases and other behaviors they display and explains the uses and limitations of classifying investors into types. Section 3 discusses how behavioral factors affect adviser-client relationships. Section 4 examines the potential effects of behavioral biases on portfolio construction. Section 5 discusses how behavioral biases affect the work of analysts, looking specifically at their forecasts, and explores remedial actions for analyst biases. Section 6 examines committee decision making and how behavioral biases may be amplified or mitigated in a group setting, and discusses steps to make committees more effective. Section 7 discusses how behavioral finance influences market behavior by examining market anomalies and observed market behavior. A summary and practice problems conclude the reading.

2

THE USES AND LIMITATIONS OF CLASSIFYING INVESTORS INTO TYPES

2.1 General Discussion of Investor Types

In recent decades, financial service professionals and researchers have been attempting to classify investors by their psychographic characteristics—in other words, by personality, values, attitudes, and interests—rather than classifying simply based on demographic characteristics. Psychographic classifications are particularly relevant with regard to individual strategy and risk tolerance. An investor's background, past experiences, and attitudes can play a significant role in decisions made during the asset allocation process. If investors fitting specific psychographic profiles are more likely to exhibit specific investor biases, then practitioners can attempt to recognize the relevant behavioral tendencies before investment decisions are made. It is important to note that because psychology is involved, no exact diagnosis can be made of any individual or situation. Although there are limitations to this type of analysis, if financial market participants can gain an understanding of their behavioral tendencies, the result is likely to be better investment outcomes.

We will now review two models of investor psychographics from the 1980s. One model was proposed in Barnewall (1987) and the other in Bailard, Biehl, and Kaiser (1986). We will then move to more recent models of investor behavior.

2.1.1 *Barnewall Two-Way Model*

One of the oldest and most prevalent psychographic investor models, based on the work of Marilyn MacGruder Barnewall and intended to help investment advisers interface with clients, distinguishes two relatively simple investor types: passive and active. Barnewall notes that “passive investors” are defined as those investors who have become wealthy passively—for example, by inheritance or by risking the capital of others rather than risking their own capital (managers who benefit when their companies do well are examples of the latter category). Passive investors have a greater

need for security than they have tolerance for risk. Occupational groups that tend to have passive investors include corporate executives, lawyers with large regional firms, certified public accountants (CPAs) with large CPA companies, medical and dental non-surgeons, small business owners who inherited the business, politicians, bankers, and journalists. Further, the smaller the economic resources an investor has, the more likely the person is to be a passive investor. The lack of resources gives individuals a higher security need and a lower tolerance for risk.

“Active investors” are individuals who have been actively involved in wealth creation through investment, and they have risked their own capital in achieving their wealth objectives. Active investors have a higher tolerance for risk than they have need for security. Related to their high risk tolerance is the fact that active investors prefer to maintain control of their own investments. Their tolerance for risk is high because they believe in themselves. When active investors sense a loss of control, their risk tolerance drops quickly. They are involved in their own investments to the point that they gather tremendous amounts of information about the investments. By their involvement and control, they feel that they reduce risk to an acceptable level, which is often fallacious (Barnewall 1987).

Barnewall’s work suggests that a simple, non-invasive overview of an investor’s personal history and career record could signal potential pitfalls to guard against in establishing an advisory relationship. Her analysis also indicates that a quick, biographic glance at a client could provide important context for portfolio design.

2.1.2 Bailard, Biehl, and Kaiser Five-Way Model

The Bailard, Biehl, and Kaiser (BB&K) model features some of the principles of the Barnewall model, but by classifying investor personalities along two axes—level of confidence and method of action—it introduces an additional dimension of analysis. Bailard, Biehl, and Kaiser (1986) provide a graphic representation of their model (Exhibit 1). Kaiser (1990) explains:

The first (aspect of personality) deals with how confidently the investor approaches life, regardless of whether it is his approach to his career, his health, or his money. These are important emotional choices, and they are dictated by how confident the investor is about some things or how much he tends to worry about them. The second element deals with whether the investor is methodical, careful, and analytical in his approach to life or whether he is emotional, intuitive, and impetuous. These two elements can be thought of as two “axes” of individual psychology; one axis is called the “confident-anxious” axis and the other is called the “careful-impetuous” axis.

Exhibit 1 Bailard, Biehl, and Kaiser Model

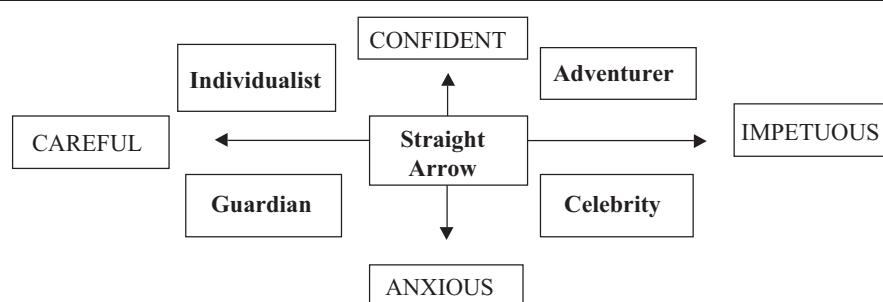


Exhibit 2 includes a synopsis of BB&K's descriptions of each of the five investor personality types that the model generates (Kaiser 1990).

Exhibit 2 BB&K Classifications

- The **Adventurer**: Adventurers may hold highly undiversified portfolios because they are confident and willing to take chances. Their confidence leads them to make their own decisions and makes them reluctant to take advice. This presents a challenge for an investment adviser.
- The **Celebrity**: Celebrities like to be the center of attention. They may hold opinions about some things but to a certain extent recognize their limitations and may be willing to seek and take advice about investing.
- The **Individualist**: Individualists are independent and confident, which may be reflected in their choice of employment. They like to make their own decisions but only after careful analysis. They are pleasant to advise because they will listen and process information rationally.
- The **Guardian**: Guardians are cautious and concerned about the future. As people age and approach retirement, they may become guardians. They are concerned about protecting their assets and may seek advice from those they perceive as being more knowledgeable than themselves.
- The **Straight Arrow**: Straight arrows are sensible and secure. They fall near the center of the graph. They are willing to take on some risk in the expectation of earning a commensurate return.

Although this model may be useful, it is possible that investors do not approach all parts of their life with equal confidence or care. It is important to focus on the approach to investing rather than placing undue focus on evidence from other aspects of their life. In addition, a limitation of all categorization schemes is that an individual's behavior patterns may change or lack consistency.

2.1.3 New Developments in Psychographic Modeling: Behavioral Investor Types

In recent years, there have been additional developments in the practical application of behavioral finance. Pompian (2008) identifies four behavioral investor types (BITs). The objective of this categorization scheme, similar to BB&K and Barnewall, is to help advisers and investors better understand investor behavior in an effort to make better investment decisions. However, the approach suggested by Pompian differs from some of the earlier approaches. This section will review the basics of developing investment plans that incorporate behavioral finance. It will build on key concepts in Pompian and Longo's article (2005) in the *Journal of Financial Planning*, and Pompian's book, *Behavioral Finance and Wealth Management* (2006).

These early works outline a method of applying behavioral finance to private clients in a way that Pompian refers to as "bottom up." This term means that for an adviser or investor to diagnose and treat behavioral biases, he or she must first test for all behavioral biases in the client. This testing is done to determine which biases a client has before being able to create an appropriate investment policy statement and a behaviorally modified asset allocation like those presented in the reading, "The Behavioral Biases of Individuals." Pompian and Longo (2005) explain how to plot bias type and wealth level information on a chart to create a "best practical allocation" or "best behaviorally modified allocation" for the client. However, some advisers may find this bottom-up approach too time-consuming or complex.

Pompian (2008) introduces a behavioral alpha (BA) approach. It is a “top-down” approach to bias identification that may be simpler and more efficient than a bottom-up approach. The BA approach is essentially a shortcut that may more efficiently identify biases for the purpose of determining which type of bias dominates. Using the BA approach, advisers and investors can test for the behavioral biases they are likely to encounter based on the psychological profile of clients and consider how to correct for or adapt to the biases.

The Behavioral Alpha Process: A Top-Down Approach

Step 1: Interview the client and identify active or passive traits and risk tolerance. Most advisers begin the planning process with a client interview, which consists mainly of a question-and-answer session intended to gain an understanding of the objectives, constraints, tolerance for accepting risk in the portfolio, and past investing practices of a client. Part of this process should also include the adviser determining whether a client is an *active* or *passive* investor, building on the work of Barnewall (1987). Through this process, the adviser is trying to determine whether the client has in the past (or does now) put his or her capital at risk to build wealth.² Understanding the characteristics of active and passive investors is important because they have tendencies toward different biases. Following is an example of a test created by Pompian (2008) to probe the risk tolerance and active/passive nature of a client. Predominantly “a” answers indicate higher risk tolerance and/or active investor traits, whereas “b” answers indicate lower risk tolerance and/or passive investor traits. Note that a traditional risk tolerance questionnaire is an appropriate way to evaluate the risk tolerance level of a client, but it may fail to address the active/passive nature of a client.

Test for Risk Tolerance and Active/Passive Traits

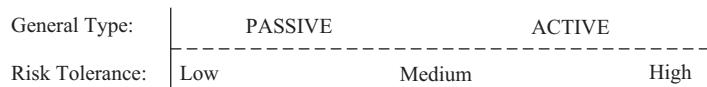
- 1 Have you risked your own capital in the creation of your wealth?
 - A Yes.
 - B No.
- 2 Which is stronger: your tolerance for risk to build wealth or the desire to preserve wealth?
 - A Tolerance for risk.
 - B Preserve wealth.
- 3 Would you prefer to maintain control over your investments or prefer to delegate that responsibility to someone else?
 - A Maintain control.
 - B Delegate.
- 4 Do you have faith in your abilities as an investor?
 - A Yes.
 - B No.
- 5 If you had to pick one of two portfolios, which would it be?
 - A 80 percent stocks/20 percent bonds.
 - B 40 percent stocks/60 percent bonds.
- 6 Is your wealth goal intended to continue your current lifestyle, or are you motivated to build wealth at the expense of current lifestyle?

² It is important to make a distinction between investing in a diversified portfolio and risking capital. Risking capital involves doing such things as building companies (big or small), investing in speculative real estate using leverage, or working for oneself rather than for a large company.

- A** Build wealth.
B Continue current lifestyle.
- 7 In your work and personal life, do you generally prefer to take initiative by seeking out what needs to be done and then doing it, or do you prefer to take direction?
A Take initiative.
B Take direction.
- 8 Are you capital preservation oriented or are you willing to put your capital at risk to build wealth?
A Capital at risk.
B Capital preservation oriented.
- 9 Do you believe in the concept of borrowing money to make money/operate a business or do you prefer to limit the amount of debt you owe?
A Borrow money.
B Limit debt.

Step 2: Plot the investor on the active/passive and risk tolerance scale. Once the adviser has classified the investor as active or passive and determined risk tolerance, the next step is to begin the process of identifying which one of the four BITs, identified by Pompian (2008) and shown in Exhibit 4, that the client falls into. The adviser's task at this point is to determine where the client falls on the risk scale in relation to how the client falls on the active/passive scale. The expectation is that active investors will rank medium to high on the risk tolerance scale whereas passive investors will rank medium to low on the risk scale. Naturally, this division will not always be the case. If there is an unexpected outcome, then the adviser should defer to the risk tolerance as the guiding factor in determining which biases to test for (see next section for more details on bias testing). Without further analysis, the expected relationship between risk and active/passive responses is shown in Exhibit 3.

Exhibit 3 Risk Tolerance and Active/Passive Scale



Step 3: Test for behavioral biases. The last step in the process is to confirm the expectation that the client has certain behavioral biases associated and consistent with a specific BIT. Exhibit 4 provides an overview of the characteristics of each BIT, and Exhibit 5 illustrates the entire diagnostic process. An expanded description of each BIT and advice for dealing with each BIT follows Exhibit 5.

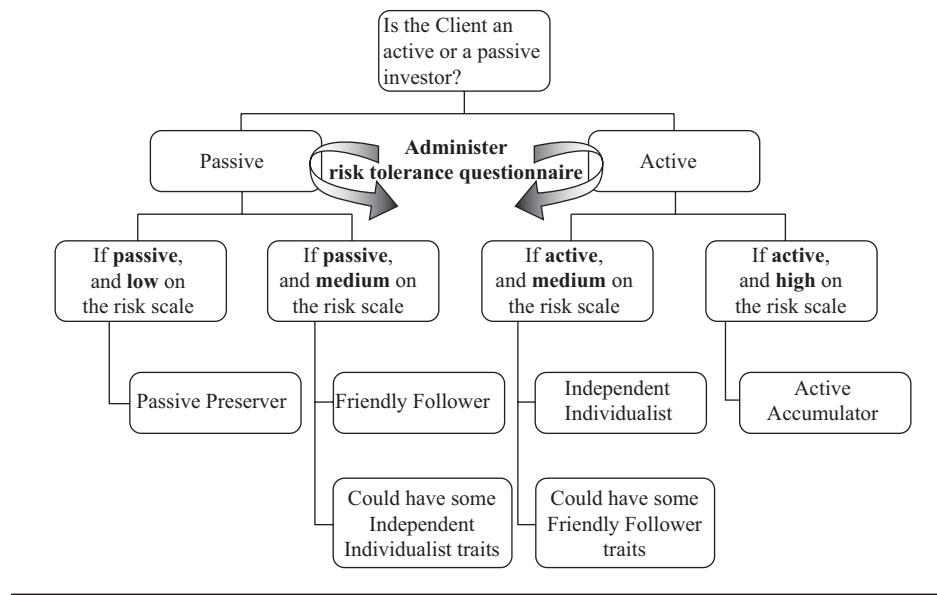
Exhibit 4 Biases Associated with Each Behavioral Investor Type

General Type	PASSIVE		ACTIVE	
Risk Tolerance	Low ◀			High ▶
Investment Style	Conservative	Moderate	Growth	Aggressive
Bias Types	Primarily emotional	Primarily cognitive	Primarily cognitive	Primarily emotional
BITs	Passive Preserver (PP)	Friendly Follower (FF)	Independent Individualist (II)	Active Accumulator (AA)
Biases				
Emotional	Endowment Loss aversion Status quo Regret aversion	Regret aversion	Overconfidence and self-attribution	Overconfidence Self-control
Cognitive	Mental accounting Anchoring and adjustment	Availability Hindsight Framing	Conservatism Availability Confirmation Representativeness	Illusion of control

One of the key observations from Exhibit 4 is that at either end of the passive/active scale are clients who are susceptible to *emotional* biases and in the middle are clients affected mainly by *cognitive* biases or errors.³ This division makes intuitive sense when the investor types are considered. Passive Preservers are conservative investors with low risk tolerance. They have a high need for security, they are highly emotional about losing money, and they become uneasy during times of stress or change. Similarly, aggressive investors with a high risk tolerance, called Active Accumulators, are also emotionally charged. They typically suffer from a high level of overconfidence and have an illusion of control; they mistakenly believe they can control the outcomes of their investments to a greater extent than they can. In between these two extremes are the Friendly Followers and the Independent Individualists who suffer mainly from cognitive biases and need education and information to make better decisions. Importantly, clients who are emotional about their investing need to be advised differently from those who make mainly cognitive errors. When advising emotionally biased investors, advisers should focus on explaining how the investment program being created affects such issues as financial security, retirement, or future generations rather than focusing on such quantitative details as standard deviations and Sharpe ratios. Quantitative measures work better with cognitively biased investors.

Step 4: Classify investor into a behavioral investor type. Once the adviser finds that the client has certain behavioral biases associated and consistent with a specific behavioral investor type, he or she will classify the client into the appropriate BIT. Exhibit 5 demonstrates the process of classifying investors into a BIT. For example if an investor is passive, the risk tolerance questionnaire reveals a low risk tolerance, and the investor has biases associated with a *Passive Preserver* as shown in Exhibit 4, the investor is then classified as a PP. Note that investors may exhibit some traits similar to the BITs shown beside them in Exhibit 5. Judgment is required in determining which classification best fits an investor.

³ Cognitive biases or cognitive errors are errors resulting from faulty reasoning; cognitive errors stem from basic statistical, information-processing, or memory errors. Emotional biases are biases resulting from reasoning influenced by feelings; emotional biases stem from impulse or intuition.

Exhibit 5 The Behavioral Investor Type Diagnostic Process**Passive Preserver (PP)**

Basic type: Passive

Risk tolerance level: Low

Primary biases: Emotional

Passive Preservers, as the name implies, are investors who place a great deal of emphasis on financial security and preserving wealth rather than taking risks to grow wealth. Many have gained wealth through inheritance or by receiving high compensation at work. Because they have gained wealth without risking their own capital, PPs may not be financially sophisticated. Some PPs are “worriers”; they obsess over short-term performance and are slow to make investment decisions because they are not comfortable with change. This behavior is consistent with the way they have approached their professional lives, being careful not to take excessive risks. Many PPs are focused on taking care of their family members and future generations, especially funding life-enhancing experiences such as education and home buying. Because the focus is on family and security, PP biases tend to be emotional rather than cognitive. This BIT becomes more common as investors’ age and wealth level increase. The emotional biases most common to PPs are endowment, loss aversion, status quo, and regret aversion. They may also exhibit cognitive errors, such as anchoring and adjustment and mental accounting.

Advising Passive Preservers: Passive Preservers may be difficult to advise because they are driven mainly by emotion. Although this characterization is true, PPs still need good financial advice. Advisers should take the time to consider the implications of the behavioral biases of their PP clients. PPs are more receptive to “big picture” advice that does not dwell on such details as standard deviations and Sharpe ratios. Because PPs are emotionally biased, providing excessive cognitive detail will lose their attention. Advisers should focus on what the money will accomplish, such as family legacy goals, education, and so on. PPs need to be persuaded about the soundness of their adviser’s general philosophy first, and then, as trust is gained, PPs will respond to advice and take

action. After a period of time, Passive Preservers are likely to become an adviser's best clients because they value greatly the adviser's professional expertise and objectivity in helping make the right investment decisions.

Friendly Follower (FF)

Basic type: Passive

Risk tolerance level: Low to medium

Primary biases: Cognitive

Friendly Followers are passive investors with a low to medium risk tolerance who tend to follow leads from their friends, colleagues, or advisers when making investment decisions. They often want to be in the latest, most popular investments without regard to current market conditions or the suitability of the investment to the FFs long-term goals. One of the key challenges in working with FFs is that they often *overestimate their risk tolerance*. Advisers need to be careful not to suggest too many "hot" ideas—FFs will likely want to invest in all of them because they may regret it if others make money and they do not. FFs generally comply with professional advice when they get it, and they educate themselves financially. At times, however, FFs can be difficult because they do not enjoy or have an aptitude for the investment process. Biases of FFs tend to be cognitive. Their decisions typically are influenced by availability, hindsight, and framing biases. Resolution of cognitive dissonance is an important factor to FFs. Regret aversion, as it relates to herding behavior, is an emotional bias with a significant impact.

Advising Friendly Followers: Friendly Followers may be difficult to advise because they often overestimate their risk tolerance. Risky trend-following behavior occurs in part because FFs often convince themselves that they "knew it all along" when an investment works out well, which increases future risk-taking behavior. Advisers need to handle FFs with care because they are likely to say yes to advice that makes sense to them without adequately considering the risk involved. Advisers need to guide them to take a hard look at behavioral tendencies that contribute to overestimating risk tolerance. Because FF biases are mainly cognitive, education on the benefits of portfolio diversification is usually the best course of action. Advisers should challenge FF clients to be introspective and provide data-backed support for recommendations. Offering education in clear, unambiguous ways is helpful so that FFs have the opportunity to understand the implications of investment choices. If advisers take the time, this steady, educational approach will generate greater client loyalty and adherence to long-term investment plans from Friendly Followers.

Independent Individualist (II)

Basic type: Active

Risk tolerance: Medium to high

Primary Biases: Cognitive

An Independent Individualist is an active investor with medium to high risk tolerance who is strong-willed and an independent thinker. IIs are self-assured and "trust their gut" when making decisions; however, when they do research on their own, they may be susceptible to acting on information that is available to them rather than getting corroboration from other sources. Sometimes advisers find that an II client made an investment without consulting anyone. This situation can be problematic; because of their independent mindset, these clients maintain the opinion they had when they made the investment, even when market conditions change. They enjoy investing and are comfortable taking risks, but often resist following a financial plan.

Of all behavioral investor types, IIs are the most likely to be contrarian, which can benefit them. II biases are typically cognitive. Conservatism, availability, confirmation, and representativeness biases are common to IIs. Overconfidence and self-attribution biases are the emotional biases that IIs sometimes exhibit.

Advising Independent Individualists: Independent Individualists may be difficult clients to advise because of their independent mindset, but they are usually willing to listen to sound advice when it is presented in a way that respects their intelligence. IIs have faith in themselves and their decisions, but may be unaware of their tendency to take a contrarian position. As with Friendly Followers, education is essential to changing their behavior because their biases are predominantly cognitive. A good approach is to have regular educational discussions during client meetings. In this way, the adviser does not point out unique or recent failures, but rather educates regularly and can incorporate concepts that he or she feels are appropriate for the Independent Individualist client.

Active Accumulator

Basic type: Active

Risk tolerance: High

Primary Biases: Emotional

The Active Accumulator is the most aggressive behavioral investor type. These clients are entrepreneurial and often the first generation to create wealth; and they are even more strong-willed and confident than Independent Individualists. At high wealth levels, AAs often have controlled the outcomes of non-investment activities and believe they can do the same with investing. This behavior can lead to overconfidence in investing activities. AAs often have high portfolio turnover rates, which normally is a drag on investment performance. AAs are quick decision makers but may chase higher risk investments that their friends or associates are suggesting. If successful, they enjoy the excitement of making a good investment. Some AAs do not accept or follow basic investment principles such as diversification and asset allocation. They are often “hands on,” wanting to be heavily involved in the investment decision-making process. AA biases are typically overconfidence, self-control, and illusion of control. As a result of these biases, they may be overly optimistic about their investment choices.

Advising Active Accumulators: Active Accumulators may be the most difficult clients to advise. They like to control, or at least get deeply involved in, the details of investment decision making. They tend to be emotional and display overconfidence, which often manifests itself as optimism. They are convinced that their investments will do well, even if that optimistic attitude is irrational. Some AAs need to be monitored for excessive spending, because they may lack self-control. This spending can inhibit performance of a long-term portfolio. The best approach to dealing with these clients is to take control of the situation. If advisers let the AA client dictate the terms of the advisory engagement, the client’s emotionally oriented decision making will dominate and the result will likely be an unhappy client and an unhappy adviser. Advisers need to prove to the client that they have the ability to make wise, objective, and long-term decisions and can communicate these results in an effective way. Advisers who take control are more likely to have Active Accumulator clients listen to and accept their advice.

2.2 Limitations of Classifying Investors into Various Types

The challenge that all financial market participants face is that behavior patterns are not consistently demonstrated. An individual may normally behave one way but at times may behave in an unexpected manner. Different and irrational behaviors are exhibited at random times, usually during periods of financial market or personal

stress. Because of inconsistencies in behavior, financial decision making is not always predictable or expectations of financial decision making are not always reliable. Therefore, it is important for readers to understand that whatever system is used to classify or otherwise understand individual investor behavior, there will be limitations to its effectiveness. The limitations of behavioral models include the following:

- 1 *Individuals may exhibit both cognitive errors and emotional biases.* Unfortunately, the same individual may exhibit both cognitive errors and emotional biases. Either may result in behavior that appears irrational. It may be possible to determine whether cognitive errors or emotional biases dominate, which is the heart of creating a behaviorally modified portfolio, but most people experience both faulty reasoning and feelings. Therefore, it may not be appropriate in most cases to classify a person as either an emotionally biased person or a cognitively biased person.
- 2 *Individuals may exhibit characteristics of multiple investor types.* Each behavioral investor type has unique characteristics. Unfortunately, people may engage in behaviors that are representative of multiple types. Therefore, users of investor classification models should not look for people to fit neatly into one “box” or type.
- 3 *Individuals will likely go through behavioral changes as they age.* As people age their behaviors may change. The most widely recognized example is that as people age their tolerance for risk (i.e., losses) generally decreases. They may become more emotional about their investing as well. It is important for BIT users to recognize this limitation and keep a close watch for changes in behavior as their clients age or experience changes in responsibilities or circumstances.
- 4 *Individuals are likely to require unique treatment even if they are classified as the same investor type because human behavior is so complex.* Even if two people fit the profile of a certain BIT, it is unlikely that one would treat those two people exactly the same. For example, one Passive Preserver may be more emotional or less risk tolerant than another. The classifications should not be taken as absolutes.
- 5 *Individuals act irrationally at different times and without predictability.* Life would be easier if we knew exactly when we or our clients would act irrationally. Because we do not, it is important to recognize that placing people into classifications may be more challenging at certain points, for example, during periods of market or personal stress compared with times of relative calm or even personal exuberance.

HOW BEHAVIORAL FACTORS AFFECT ADVISER–CLIENT RELATIONS

3

As behavioral finance gains credibility and acceptance by the investment community, advisers and investors are increasingly likely to include behavioral considerations in a client's investment policy statement (IPS). By adding behavioral factors to the IPS, a number of benefits can be realized. There is no doubt that an understanding of investor psychology will generate insights that benefit the advisory relationship. The key result of a behavioral finance–enhanced relationship will be a portfolio to which

the adviser and client can comfortably adhere while fulfilling the client's long-term goals. This result has obvious advantages: advantages that suggest behavioral finance will continue to play an increasingly influential role in portfolio structure.

However, because behavioral finance is a relatively new concept as applied to individual investors, investment advisers may be reluctant to accept its validity. Moreover, advisers may not feel comfortable asking their clients psychological or behavioral questions to ascertain biases, especially at the beginning of the relationship. This reluctance should not deter an adviser from considering behavioral factors. Inclusion of behavioral finance considerations in the client–adviser relationship will likely result in a more satisfactory relationship and in investment decisions that are closer to those of traditional finance while being easier for the client to accept and adhere to.

Wealth management practitioners have different ways of measuring the success of an advisory relationship, but few would dispute that every successful relationship shares a few fundamental characteristics, including the following as outlined by Pompian (2006):

- 1 The adviser understands the client's financial goals and characteristics. These are considered when developing the investment policy statement.
- 2 The adviser maintains a systematic (consistent) approach to advising the client.
- 3 The adviser invests as the client expects. Results are communicated on a regular basis and in an effective manner that takes into account the client's characteristics.
- 4 The relationship benefits both client and adviser.

Behavioral finance can enhance these areas as shown in the following sections.

3.1 Formulating Financial Goals

Experienced financial advisers know that defining financial goals is critical to creating an investment program appropriate for the client. To best define financial goals, it is helpful to understand the psychology and emotions involved in the decisions underlying the goals. Behavioral finance helps advisers discern why investors set the goals they do. Such insights equip the adviser to deepen the bond with the client, thus producing a better relationship and a better investment outcome.

3.2 Maintaining a Consistent Approach

Most successful advisers maintain a consistent approach to delivering wealth management services. Incorporating behavioral finance can become part of that discipline without requiring large-scale changes in the adviser's methods. Behavioral finance can also add professionalism and structure to the relationship, allowing advisers to better understand the client before delivering any investment advice. Clients will appreciate this step, and it will make the relationship more successful.

3.3 Investing as the Client Expects

Addressing client expectations is essential to a successful relationship; in many unfortunate instances, the adviser does not deliver on the client's expectations because the adviser does not understand them. Perhaps no other aspect of the advisory relationship could benefit more from behavioral finance. Behavioral finance provides a context in which the adviser can "take a step back" and attempt to explore the motivations of the client. With a more thorough understanding of the client's expectations, the adviser is better equipped to help satisfy them.

3.4 Ensuring Mutual Benefits

Measures resulting in happier, more satisfied clients will also improve the adviser's practice and work life. Incorporating insights from behavioral finance into the advisory relationship will enhance that relationship and its results. Those in the individual investor advisory business should be aware that factors other than investment results may be considered when clients seek new advisers. Practitioners may lose clients because clients do not feel as though their advisers understand them and/or their financial objectives. Likewise, practitioners may gain clients because clients feel as though their advisers understand them and/or their financial objectives. The primary benefit that behavioral finance offers is the ability to develop a stronger bond between clients and advisers. By "getting inside the head" of the client and developing a comprehensive grasp of his motives and fears, the adviser can help the client better understand why a portfolio is designed the way it is and why it is an appropriate portfolio for him or her, regardless of what happens day-to-day in the markets.

3.5 Limitations of Traditional Risk Tolerance Questionnaires

Today, a dizzying variety of sources supply financial advice. To standardize processes, financial services firms often administer, and require their advisers to administer, risk tolerance questionnaires to clients and prospects prior to drafting any asset allocation. In the absence of any other diagnostic analysis, this methodology is certainly helpful and can generate important information. However, it is important to recognize the limitations of risk tolerance questionnaires. Aside from ignoring behavioral issues, an aspect we will examine shortly, risk tolerance questionnaires can also generate dramatically different results when administered repeatedly to the same individual, but with slight variations. Such imprecision arises primarily from variations in wording. Additionally, many risk tolerance questionnaires are administered once, and may not be revisited despite the fact that an IPS should be reviewed at least annually to measure not only a client's ability to take risk but also their willingness to take risk. Risk tolerance can vary as a result of changing life stages or events so it is critical to re-evaluate it periodically. Another critical drawback of risk tolerance questionnaires is that many advisers interpret their results too literally. For example, some clients might indicate that the maximum loss they would be willing to tolerate in a single year would equal 20 percent of their total assets. Does that mean that an ideal portfolio would place such a client in a position to lose 20 percent? No! Advisers should set portfolio parameters that preclude a client from incurring the maximum specified tolerable loss in any given period. For these reasons, risk tolerance questionnaires provide only broad guidelines for asset allocation, and should be used in concert with other behavioral assessment tools.

From the behavioral finance perspective, risk tolerance questionnaires may work better as a diagnostic tool for institutional investors compared with individual investors. This difference is because institutional investors are familiar with mean–variance optimization and think about risk. For them, risk analysis is a cognitive process. Individual investors are more likely to have feelings about risk, and for them risk analysis is an emotional process. Thus, risk tolerance questionnaires may fail emotionally biased individuals. An asset allocation generated and executed based on mean–variance optimization may result in a scenario in which a client demands, in response to short-term market fluctuations and to the detriment of the investment plan, that his or her asset allocation be changed. Moving repeatedly in and out of an allocation can have serious long-term negative consequences. Behavioral biases should be identified before the allocation is executed, so that such problems can be avoided. By doing so,

the IPS that includes behavioral factors may result in decisions that the investor can adhere to. The IPS can be re-evaluated on a regular basis and updated for changes in the investor's circumstances and risk tolerance.

4

HOW BEHAVIORAL FACTORS AFFECT PORTFOLIO CONSTRUCTION

Behavioral biases may affect how investors construct portfolios from the securities available to them. One way to consider this issue is to analyze the actual portfolios investors construct and compare them with the portfolios implied by traditional portfolio theory. Some useful evidence on the portfolio selection decisions of individual investors comes from defined-contribution (DC) pension plans. In particular, investment decisions in US 401(k) plans have been investigated in a number of studies.⁴

4.1 Inertia and Default

Consistent with the status quo bias,⁵ a key finding is that most DC plan participants show inertia and tend not to change their asset allocations through time, even though it might be assumed that their tolerance for risk and other circumstances would be changing. For example, Samuelson and Zeckhauser (1988) and more recently Ameriks and Zeldes (2000) find the majority of investors in their samples made zero fund switches during the sample period in spite of there being no transaction costs associated with altering allocations among funds.⁶

There is also substantial evidence that shows inertia leads plan participants to stick with default options in terms of contribution rates and investment funds. In many cases, the default funds will be cash or money market funds, which are arguably too conservative for long-term savings, with low risk but also low rates of return (for example, see Madrian and Shea 2001).

Some companies have introduced “autopilot” strategies to counteract the inertia that plan participants frequently exhibit. For example, target date funds automatically switch from risky assets to fixed-income assets as the plan participant nears the intended retirement date. The participant does not need to take any action to achieve the reduction in risk. Although target date funds can be helpful in countering investor inertia, the potential disadvantage is that they are a “one size fits all” solution that may not match the needs of specific investors.

4 A 401(k) plan is a type of pension (retirement savings) plan named after the section of the US Internal Revenue Code in which it appears. A company sponsors the plan but each participant has his or her own account and makes investment decisions for that account.

5 The status quo bias is an emotional bias in which people do nothing or maintain the status quo instead of making a change.

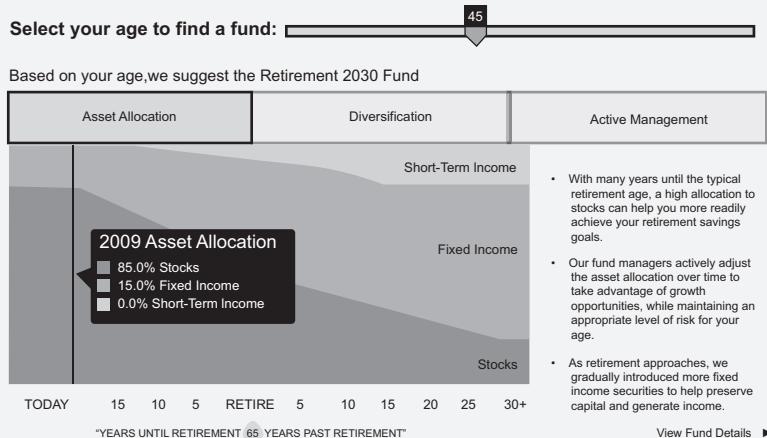
6 The investors sampled held defined-contribution plans through TIAA-CREF in the United States. TIAA-CREF has been helping those in the academic, medical, cultural, and research fields plan for retirement for over 90 years.

EXAMPLE 1**Target Date Fund Glide Path**

Target date funds are designed to deal with investor inertia. As the investor approaches the intended retirement date, the fund manager reduces the proportion of risky assets in the fund. The reduction in risky assets is because plan participants close to retirement have little time to recover losses or make adjustments to their circumstances if their risky investments incur losses. Investors with longer to retirement are typically more able to bear investment risk.

Although investors could do this kind of risk management for themselves, in practice many would not get around to making the allocation changes. The target date fund manager provides an autopilot solution for them. The diagram below shows the asset allocation “glide path” that T Rowe Price suggests for a 45-year-old investor. As shown, the allocation to stocks will decline (glide down) over time, whereas the allocation to fixed income and short-term income will increase. Similar programs are offered by other investment management companies.

Discuss factors that might make this one-size-fits-all solution inappropriate.

**Solution:**

The entire investment portfolio of the investor should always be considered. Where tax treatment differs among types of returns or assets, assets that are expected to generate higher taxable returns may be held in tax-deferred retirement funds. An investor with significant amounts invested in non-retirement funds might prefer to tax shelter some assets in their retirement funds.

An investor with significant wealth and no children may be willing to take more risk. They may be less loss- and risk-averse than another investor of the same age with less wealth and parental responsibilities.

An investor with a preference for active portfolio management might prefer to have different allocations to asset classes based on his or her expectations and market conditions. For example, if interest levels are historically low, the investor might prefer to invest in stocks anticipating that interest rates will rise and the fixed-income portion will decline in value.

These are some of the factors that might be discussed.

4.2 Naïve Diversification

When DC plan members do make active fund choices, some of the decisions appear to be the result of behavioral biases. For example, there is evidence of investors using simple heuristics to allocate among available funds and of framing bias. Benartzi and Thaler (2001) cite evidence of plan participants using a “1/n” naïve diversification strategy—dividing contributions equally among available funds irrespective of the underlying composition of the funds. In one experiment conducted by Benartzi and Thaler, one group of subjects is given the choice between a stock (equities) fund and a bond fund and a second group of subjects is given a choice between a stock fund and a balanced (50 percent stock, 50 percent bond) fund. The average asset allocation to equities is higher for the second group because in each group, the mode is to allocate assets evenly between the two funds available for selection. The use of a heuristic and framing bias appear to have impacted the choices. In a real life example studied by Benartzi and Thaler, by comparing allocations of a plan with five stock funds and one bond fund and a second plan with one stock fund and four bond funds, they find average equity allocation is very different. In the first plan, the average equity allocation is 75 percent, and in the second plan, the average equity allocation is only 34 percent. This example demonstrates the impact of framing bias.

Not all researchers support the idea that investors follow a 1/n strategy. Huberman and Jiang (2006) counter that most participants choose between three and five funds, and that the number chosen is not sensitive to the number of funds on offer (n). However, they do find evidence of participants following a *conditional* 1/n strategy, by allocating equally among their chosen subset of funds. In other words, once they have selected their funds, they allocate the invested amount equally among the chosen funds.

Regret may play a role in explaining naïve diversification strategies. Benartzi and Thaler (2007) cite an interview with Harry Markowitz in which he notes that he selected a 50/50 allocation between stocks and bonds in his TIAA-CREF retirement account. He states that his intention was to minimize future regret from one asset class beating the other, an essentially behavioral explanation, and perhaps an emotional one.

4.3 Company Stock: Investing in the Familiar

A very graphic example of potentially inappropriate portfolio construction approaches in DC plans comes in the form of high levels of investment in the stock of the sponsoring company. Many US 401(k) plans offer the employer’s stock as an investment option and many also make employer matching contributions in employer stock, in some cases with restrictions on subsequent sale.

Benartzi (2001) notes that one-third of 401(k) assets are invested in participants’ own employer’s stock, and in some plans the proportion is more than 90 percent. In many cases, the account balances are comprised in significant part by the employees’ *discretionary* allocations. Vanguard (2006) notes that although only 12 percent of plans offer employer’s stock as a choice, these are larger plans. As a result, 43 percent of participants have employer’s stock as a choice and one-fifth of all participants have more than 20 percent of their account balance in employer’s stock. Fifteen percent of participants have more than 80 percent of their account balance in their employer’s stock. Balances in employer’s stock remain high despite such high profile disasters as WorldCom and Enron.⁷

⁷ Choi, et al (2005) note that at the end of 2000, 62 percent of the \$2 billion of assets in Enron’s 401(k) plan accounts was invested in Enron stock.

Explanations given for investment in employer's stock include the following:

- *Familiarity and overconfidence effects:* Employees underestimate risk because of familiarity with the employing company and overconfidence in their estimates of the company's performance. A John Hancock (2003) survey shows investors assigning an average risk score of 3.1 to company stock, in comparison with 3.6 for domestic stock funds and 4.1 for global stock funds. Huberman (2001) argues this enthusiasm for own company investment springs from the same familiarity bias that leads to home bias in geographic allocations. The familiarity bias also led US investors to invest more in their local phone company than in other telephone companies. It could be that employees do have an informational advantage that justifies their high holdings in their employer's stock, but evidence on returns (e.g., Benartzi 2001) casts doubt on this view and points to overconfidence as an explanation.
- *Naïve extrapolation of past returns:* Plan participants at companies whose stock has done well in the past may expect this performance to continue and hence wish to hold company stock in their account. Benartzi (2001) sorts companies into quintiles based on 10-year past performance of the employing company's stock. Employees at the worst-performing companies on average allocate 10 percent of contributions to company stock; for the best-performing companies, the figure is 40 percent. Subsequent stock performance does not validate this difference in allocation.
- *Framing and status quo effect of matching contributions:* Benartzi (2001) shows that employees who can choose where the employer match is invested allocate 18 percent of their own funds to employer's stock. Where the match is in employer's stock, employees allocate 29 percent of their *own* contributions. Employees may be taking the company's decision to contribute stock to their plan as *implicit advice*.
- *Loyalty effects:* Employees may be willing to hold employer's stock to assist the company, as they perceive it. For example, employees may be encouraged to hold employer's stock as assistance in a takeover defense. Companies with high levels of employee stock holdings may be harder to take over.
- *Financial incentives:* Employees might rationally invest in employer's stock when there are financial incentives for them to do so. These could include being able to purchase stock at a discount to market price, or beneficial tax treatment. Although these explanations are possibilities, most studies show substantial holdings of employer's stock exist in the absence of such incentives. However, this finding may be the result of inertia and employees continuing to hold employer's stock once any restrictions on selling have lapsed.

4.4 Excessive Trading

The evidence of participant inertia in DC plans is in contrast to evidence of individuals with retail investment accounts. Investors with retail accounts appear to be more active traders. Barber and Odean (1999) summarize evidence from their studies of investors with discount brokerage accounts. The main findings are that investors trade too much—damaging returns—and tend to sell winners and hold on to losers—the disposition effect.

A winning position, in which current price is above the purchase price, is 1.5 times more likely to be sold in any month than a corresponding losing position. This behavior may be driven by fear of regret. Winners sold subsequently outperform the losers that remain in the portfolio. Excessive trading appears to be driven by overconfidence. Overconfident investors may falsely think that they have the knowledge and

insight to make profitable trades, and trade actively to benefit from these insights. The researchers' initial expectation that frequent traders would be worse off because of their transaction costs is not confirmed; in fact, the outcome was even worse than expected in that stocks sold do better than stocks bought by about 3.5 percent over the following 12 months. The frequent traders not only had higher transaction costs because of excessive trading but also experienced opportunity losses because of the disposition effect. Performance is negatively related to turnover levels. Young males are found to trade the most and earn the lowest net returns.

The difference between the findings on trading in the discount brokerage and the 401(k) pension plan accounts may stem from self-selection of individuals (keen traders) into brokerage accounts and the differing levels of investment choice (i.e., choice is generally restricted in 401(k) plans).

4.5 Home Bias

Portfolio diversification represents another dimension in which investors must make a choice. Plan participants can diversify internationally as well as across asset classes. A large body of literature exists showing that many investors maintain a high proportion—often 80 percent or more—of their investments in securities listed in their own country (for example, see French and Poterba 1991; Kang and Stulz 1997). There have been attempts to offer rational explanations for this feature, for example, as a result of information costs. However, there are also behavioral explanations, such as availability, confirmation, illusion of control, endowment, and status quo biases. Familiarity with a country may lead investors to own high concentrations of domestic assets. This choice is closely related to the idea that a similar type of familiarity could lead investors to own excessive amounts of employer stock.

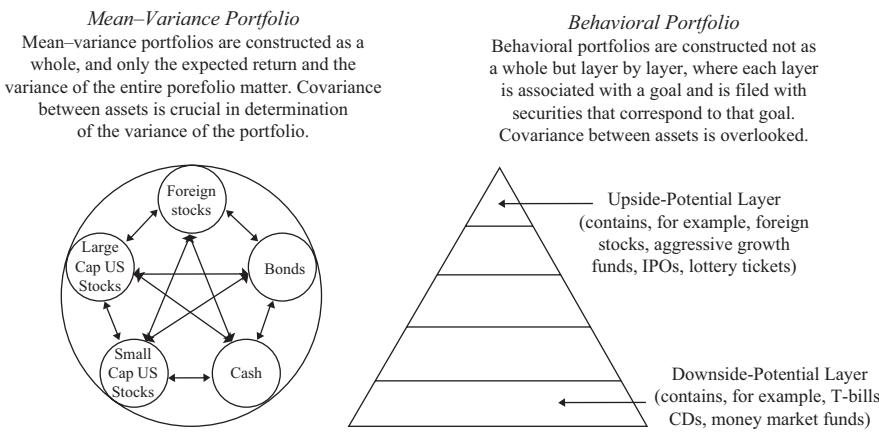
4.6 Behavioral Portfolio Theory

Shefrin and Statman have published a number of articles on behavioral portfolio theory (e.g., Shefrin and Statman 2000; Statman 1999, 2004). The theory is intended to reflect how investors actually form portfolios rather than how traditional theory suggests they should. Shefrin and Statman argue that portfolios, affected by behavioral biases, are formed as layered pyramids in which each layer is aligned with an objective. As a result of a mental accounting bias in which people treat one sum of money differently from another sum based on which mental account the money is assigned to, investments are allocated to discrete layers without regard for the correlations among these investments. For example, a base layer of low risk assets may be intended as “protection from poverty,” whereas a higher layer of risky assets represents “hopes for riches.” Behavioral investors do not consider the correlation between the layers in the way that modern portfolio theory would suggest they should. Clients can have several layers or mental accounts in their portfolios. The layered approach can explain observed features, such as undiversified stock portfolios (hopes for riches), and the reluctance of investors to invest in foreign stocks despite the seemingly obvious diversification benefits. This latter feature reflects failure to consider the diversification benefits of stocks with a low correlation with the domestic portfolio. The failure to consider diversification benefits is an implication of the mental accounting bias.

An important point to note is that investors do not have a single attitude toward risk. They have multiple attitudes toward risk depending on which part of their wealth is being considered. Hence, in a behavioral context it might make sense for investors to say they are prepared to take a lot of risk with some of their money, even though such a statement makes little sense in a conventional mean–variance portfolio theory framework.

Advisers and portfolio managers constructing an investment policy statement for or with a client may wish to consider behavioral portfolio theory. For example, they can clarify which mental accounts the client has and what attitude toward risk prevails for each one. Exhibit 6 compares the structure of a mean–variance portfolio and a behavioral portfolio (Statman 1999).

Exhibit 6 Structures of Mean–Variance and Behavioral Portfolios



Source: Statman (1999).

BEHAVIORAL FINANCE AND ANALYST FORECASTS

5

Sections 2, 3, and 4 focus on understanding individual investor behavior and how it affects the adviser–client relationship and portfolio construction. Sections 5, 6, and 7 focus on how behavioral factors impact security analysts, investment committees, and markets.

Studies have shown that experts in many fields persistently make forecasting errors arising from their behavioral biases. Investment analysts are subject to these biases, and need to be aware of the potential for biases to compromise their professional judgment. When qualified, analysts possess a range of techniques to research companies and securities, yet their superior skills surprisingly place them at greater risk of some types of error. One key issue for all experts is recognizing the occasions when they lack the information or insight to make a good professional judgment. Even possessing good analytical skills, investment professionals' judgment can be limited by human failings and the environment in which they operate. Judgment can be improved if an individual understands the limits to his or her knowledge.

The biases that can adversely impact analysis are not confined to analysts' behavior. The way in which information is presented in company management presentations, reports, and accounts can reflect human biases in corporate executives. To achieve good forecasts or decisions, analysts need to be alert to the potential impact of biases.

Section 5.1 describes the effect of *behavioral biases* on analysts and their work. *Cognitive errors* or failures of reasoning create the potential for errors of judgment, and include memory- and probability-based errors. *Emotional biases* are biases resulting from reasoning influenced by feelings; emotional biases stem from impulse or intuition. *Cognitive dissonance* arises when new information conflicts with previously held

beliefs or cognitions. To resolve the dissonance, people may notice only information of interest, may ignore or modify information that conflicts with existing beliefs, may remember and consider only information that confirms existing beliefs, and/or may modify beliefs. The work of analysts, which includes research, judgment, forecasts, decisions, and conclusions, may be affected by behavioral biases and cognitive dissonance. In other words, analysts are not immune to behavioral biases and exhibiting irrational behavior.

5.1 Overconfidence in Forecasting Skills

Overconfidence is a key behavioral bias relevant to investment analysts. Overconfidence bias is a bias in which people demonstrate unwarranted faith in their own intuitive reasoning, judgments, and/or cognitive abilities. This overconfidence may be the result of overestimating knowledge levels, abilities, and access to information. For example, people generally do a poor job of estimating probabilities but believe they do it well because they believe that they are smarter and more informed than they actually are. This behavior is sometimes referred to as the *illusion of knowledge bias*. Overconfidence may be intensified when combined with *self-attribution bias*. Self-attribution bias is a bias in which people take credit for successes and assign responsibility for failures. In other words, success is attributed to the individual's skill whereas failures are attributed to external factors. Illusion of knowledge and self-attribution biases contribute to the overconfidence bias.

Analysts frequently show excessive confidence on the likely correctness of their forecasts. Studies have identified that 90 percent *confidence intervals* for forecasts, which should leave only 10 percent error rates, turn out to be wrong as much as 40 percent of the time (Russo and Schoemaker 1992). The actual error rate is the result of a calibration issue about how sure an expert is about his or her judgment.

Overconfidence can be the result of placing too much emphasis on specific characteristics of a company or what is being examined and neglecting to fully consider the impact of the economic environment and other information. Studies have suggested individuals are more confident when making contrarian predictions that counter the consensus. That is, overconfidence can arise when forecasting what others do not expect or predict (Dunning, Griffin, Milojkovic, and Ross 1990). Overconfidence has been shown to be particularly evident for strategists, rather than for individual stock or industry analysts. Stock analysts are typically more confident about earnings forecasts than target prices.

A key bias linked to overconfidence is the illusion of knowledge. Analysts believe that by acquiring information, they can know more than others and obtain an edge. In other words, information will result in analysts being more knowledgeable and thus more accurate in their forecasts compared with others. As a result, they may collect too much information. Although forecasting is driven by information, additional data that is not adding material content tends not to increase the accuracy of a forecast, but instead reinforces an analyst's confidence in that forecast.

Additional information may contribute to the cognitive bias of representativeness, in which analysts judge the probability of a forecast being correct by considering how much the outcome resembles overall available data (Kahneman, Slovic, and Tversky 1982 and more recently, Shefrin 2007). Typically, this simplification combines probabilities incorrectly. Additional information or detail may appear to conform to the overall scenario being forecast, even if it is largely irrelevant, and so add to confidence in the forecast. The **availability bias** is a cognitive bias that involves individuals giving undue weight to more accessible, readily recalled information. Availability and representativeness can each encourage overreaction to rare events.

Attempting to collect more information can also contribute to the cognitive bias of **illusion of control**, which is a tendency of analysts to try to control what cannot be controlled. Inherently, uncertain outcomes relating to business or the economy cannot have all forecasting risk removed. Risk in a model and the modeling process cannot be eliminated by an excess of information. The illusion of control can lead to analysts forecasting complex patterns of business performance or stock price behavior, or being confident about unlikely combinations of short- and long-term recommendations, price targets, and earnings forecasts.

Overconfidence and the illusion of control can be encouraged by *complex models*. Many analytical problems will require modeling and extensive use of data. More complex models usually fit a particular data set better but prove less robust in a range of different environments. The data set used may be more relevant to a particular economic or business environment or may be influenced by some outlying or atypical observations. Mathematical rigor and spurious precision of models can conceal underlying weaknesses in the models and assumptions. Analysts should avoid modeling that overly focuses on a single set of historical data, which risks optimization on that data set rather than achieving robustness of modeling. Robustness reflects a model's ability to perform well out of sample.

Even when analysts are not managing portfolios of securities, **self-attribution bias** can adversely influence their analyses and contribute to overconfidence in their forecasts. Self-attribution bias is a bias in which people take personal credit for successes and attribute failures to external factors outside the individual's control. Self-attribution bias may reflect a desire to preserve self-esteem while people protect themselves psychologically as they attempt to comprehend successes and failures. Self-attribution bias may be evident in *skewed forecasts*, in which the confidence interval is not symmetric around a central forecast. People may appear to exhibit self-attribution bias as a result of misdirected financial incentives. In this case, it is not true self-attribution bias but a deliberate attempt to gain credit for successes and assign responsibility for failures for financial as opposed to psychological reasons.

Experts often use other self-esteem or ego defense mechanisms, such as **hind-sight bias**. Hindsight bias is also called the "I knew it all along" effect. Forecasts are evaluated with hindsight, and that additional knowledge can be combined with a human tendency to see past events as having been predictable. Also, people tend to remember their own predictions of the future as more accurate than they actually are because they are biased by the knowledge of what has actually happened. Hindsight bias is more prevalent when forecasts are ambiguous. Individuals tend to misinterpret past data, which can lead to overconfidence and insufficient adjustment in future forecasts. Hindsight bias can make analysts blind to future risks or the full breadth of the range of outcomes.

Hindsight bias can involve both cognitive and emotional bias. It is a result of the process of integrating new information with prior beliefs. A source of error in calibrating earlier forecasts typically arises from selective recall, in which individuals remember showing greater foresight than proved to be the case. Typically, an outcome is viewed as more likely, in the sense of being capable of being repeated, once it has occurred than is expected before that.

EXAMPLE 2

Analyst Case Study

Based on a company's sales and earnings per share growth over the past 10 years, an analyst has concluded that its high rate of growth will continue in the future. Before the report is completed, the analyst reads in a newspaper that the company's chief executive has made an apparently very profitable personal investment

in another unrelated business. The analyst believes that this profitable outcome is evidence of the chief executive's entrepreneurship and dynamism, and that it is additional confirmation of the analyst's assessment of the company in the report. Supported by the additional information, the analyst now feels more confident with the forecasted growth rates and in fact increases the average forecasted earnings growth rate and decreases the dispersion of the forecasted growth rates. He includes the additional information about the chief executive in the report.

Discuss flaws in the analyst's approach and possible biases of the analyst.

Solution:

The value of the additional information is difficult to quantify, and it may not have been collected systematically. The analyst may not have looked as rigorously for evidence of how representative the successful investment was among the chief executive's total portfolio of personal investments; other investments might have shown poor returns but received less publicity. Newspaper coverage can be selective. Thus, the new information might reflect *availability bias*. The chief executive may even have been motivated to diversify his investments by concern about the outlook for the company's stock. The analyst's judgment might have been adversely affected by *overconfidence*, with faulty reasoning contributing to the issue. Further, the analyst might have seen the additional information as being *representative* of a mental picture of the characteristics of a growth business.

5.1.1 Remedial Actions for Overconfidence and Related Biases

Dealing with overconfidence is difficult, but *prompt and accurate feedback* combined with a *structure that rewards accuracy* can help analysts to re-evaluate their processes and self-calibrate. Most people calibrate better and reduce overconfidence if they know that the result of their forecast will be known and reflected to them very quickly.

Effective methods of providing incentives need not necessarily be in the form of financial reward. Good motivation can also be achieved if an individual is directly accountable for accuracy to supervisors or clients. An appreciation of stock market history and economic cycles, as well as rigorous self-appraisal, can help improve future forecasts and correct confidence intervals given by analysts. Where resources and organizational structure permit, *appraisal by colleagues, superiors, or systems* can also help calibrate forecasts and control overconfidence.

Well-structured feedback can also reduce hindsight bias. An analyst should document a decision or forecast and the reasons for that judgment. A written record helps make the later evaluation more objective. Documenting the reasons for the judgment not only allows the accuracy to be assessed later, but also why it was right or wrong. The data used should be recorded to allow subsequent assessment. Unambiguous forecasts are less vulnerable to hindsight bias. Where possible, numbers should be included, and it can be helpful to document any consensus or base rates that exist, to compare with the analyst's judgment and for later assessment purposes.

To address hindsight bias and other biases, analysts should make the conclusion as explicit as possible, although this documenting should not be confused with showing greater confidence or adding extraneous detail. What is required is sufficient detail to allow subsequent evaluation of its accuracy. In subsequently evaluating a forecast after the outcome is known, the record of the prediction can be assessed by reviewing the data, assumptions, and model. Feedback or a systematic review process can assist future accuracy and help control overconfidence and reduce hindsight bias.

Some outcomes or sources of forecasting error can be overlooked. Analysts should be thorough in their search for unconsidered outcomes that might have been missed initially and attempt to evaluate those. One method that can help reduce overconfidence is for an analyst to be required to provide at least one counterargument in

the report. If the documentation of the research includes one good reason why the conclusion might turn out to be wrong, forecasting accuracy can be improved and confidence be better calibrated. When listing evidence for and against a conclusion, it is the evidence against that does the most good in countering overconfidence.

To counter the risk of inaccuracy and excess confidence based on specific characteristics of the subject of the analysis, analysts should consider whether the sample size is too small. Ensuring that a search process includes only *comparable data* is also helpful to reducing overconfidence. Additional data that cannot be analyzed in the same way as the comparable data set are more likely to add to confidence than accuracy, via the bias of illusion of knowledge.

Bayes' formula is a mathematical rule that explains how existing probability beliefs should be changed given new information. In other words, Bayes' formula expects people to update old beliefs in a certain manner when given new information. Bayes' formula is essentially an application of conditional probabilities.⁸ Ideally, analysts should incorporate additional information with a Bayesian approach to calculate probabilities, recognize underlying base rates, and link probabilities conditionally.

Using Bayes' formula, the initial position (prior probability) typically matters less, and more importance can be given to a sequence of useful evidence. Because the starting assumptions are typically less important than collecting and incorporating new information, Bayes' formula can be a useful tool for analysis, reducing the risk of behavioral biases in incorporating new information.

However, base rates—the underlying averages or background frequencies—should be recognized if the data is available. Indeed, in some cases the base rates can be clear and powerful. In some investment analyses the base rate of likely outcomes may be statistically significant, but there is much less information that allows discrimination between investments. For example, there may be insufficient data to determine accurately stock betas in a model. The analysis may be more robust if calculated assuming all the stock betas are equal to 1 (the overall average or base rate).

In Example 3, the correlations and similarity of previous performance between stocks, which can be high within some sectors, demonstrate the difficulty of discriminating between stocks in the short term. Against this background—where it seems quite likely that short-term performance of the two stocks will be similar—achieving a successful recommendation requires a higher hurdle in terms of further evidence and quality of analysis.

8 Bayes' formula shows how one conditional probability is inversely related to the probability of another mutually exclusive outcome. The formula is:

$$P(A|B) = [P(B|A) / P(B)]P(A)$$

where

$P(A)$ = the prior probability of event A, without new information B. It is the base rate or base probability of event A.

$P(A|B)$ = the conditional probability of event A. It is the updated probability of A given the new information B.

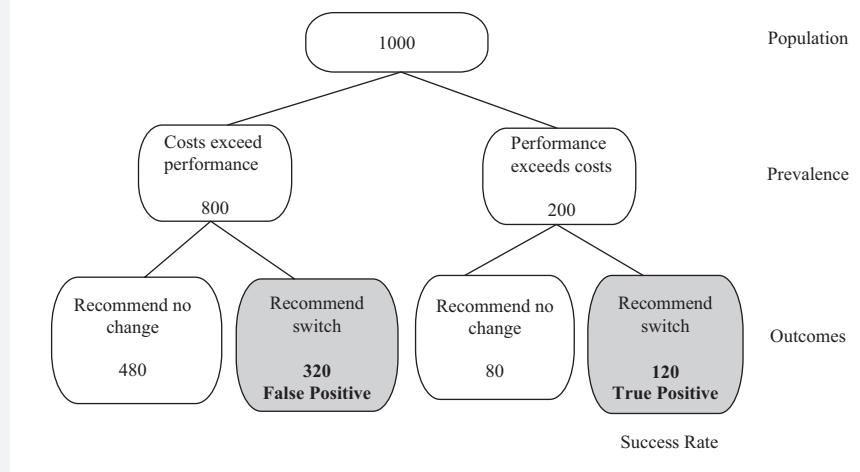
$P(B|A)$ = the conditional probability of B given A. It is the probability of the new information B given event A.

$P(B)$ = the prior (unconditional) probability of information B.

EXAMPLE 3**Analyst Recommendation and Base Rate Case Study**

The chief investment officer (CIO) of an investment institution is presented with research by an analyst on his team. The analyst is recommending a switch from the stock of one major integrated oil company, XYZ plc, into another major integrated oil company, ABC plc. Over the previous three years, the stock prices of the two companies had a correlation of 88 percent. On the basis of this high correlation and also the fact that over the period the performance of the two stocks had diverged little, the CIO concludes that the probability of switching costs exceeding the difference in prospective returns over the next 12 months is 80 percent (base rate or prior probability). The CIO estimates the cost of the switch at 4 percent because tax costs are involved. The analyst's judgment is correct 60 percent of the time, in line with the average for the team. How should the CIO evaluate the analyst's recommendation?

Solution:

Exhibit 7 Bayes' Formula Demonstrated Using Natural Frequencies

The information in Exhibit 7 is summarized in Exhibit 8.

Exhibit 8

	Switching Is Worthwhile	Switching Is Not Worthwhile	Total
Analyst recommends a switch	120	320	440
Analyst recommends no change	80	480	560
Total	200	800	1000

$P(A) = \text{Probability switching is worthwhile} = 1 - 0.8 = 0.2$ (given), or
 $200/1000 = 0.2$

$P(B) = \text{Probability analyst recommends a switch} = 440/1000 = 0.44$

$P(B|A) = \text{Probability analyst recommends a switch given switching is}$
 $\text{worthwhile} = 0.6$ (given), or $120/200 = 0.6$

If a population of 1000 outcomes is used, on average in 800 ($= 0.8 \times 1000$) outcomes there will be less than 4 percent annualized difference between the stocks. On the other 200 ($= 0.2 \times 1000$) outcomes, it would be worth switching.

The analyst's 60 percent rate of being correct means on average that he can be expected to identify correctly 120 ($= 0.6 \times 200$) of the useful switching opportunities. But his 40 percent failure rate means that he will not predict the remaining 80 ($= 0.4 \times 200$) outcomes when switching would prove right (false negatives).

Of the 800 outcomes in which switching would not be worthwhile, the analyst will correctly recognize 480 of the outcomes ($= 0.6 \times 800$). But he will wrongly predict a switch on the remaining 320 outcomes in which there is no meaningful difference between the stocks (false positives).

Exhibit 8 indicates that the analyst will make 440 calls to switch ($= 120 + 320$), of which just 120 can be expected to be correct. The analyst's expected success ratio in calling a profitable switch between two closely correlated stocks is 27 percent ($= 120/440$) or calculated using Bayes' formula: $P(A|B) = [P(B|A)/P(B)]P(A) = [(0.6)/(0.44) \times 0.2] = 1.36 \times 0.2 = 0.27$

The CIO would need more information about time frames and predicted magnitude of performance difference between the stocks before making a decision. However, in these circumstances, the base rate—the similar prior performance of the two stocks—is hard to beat. (Switching costs and the possibility that some outcomes represent an unexpected outperformance of XYZ may even add to the risks.) Where a base rate or prior is very strong, a decision counter to the base rate can only be made with a strong proven ability to discriminate.

Remedial actions include giving prompt, well-structured, and accurate feedback; developing explicit and unambiguous conclusions; having a systematic review process and a structure that rewards accuracy; conducting regular appraisals by colleagues and superiors; providing counterarguments; and documenting comparable data.

5.2 Influence of Company's Management on Analysis

The information that is presented by company management and the way the information is presented can affect external analysts. Analysts should remember that company management is also susceptible to behavioral biases.

Framing, anchoring and adjustment, and availability are important cognitive biases. Framing is a cognitive bias in which the same problem is assessed differently depending on how information or a question is presented. Humans assume that the frame or context is providing additional information when it may not be. It can involve anchoring, in which some information is given undue importance in decision making. Anchoring means that the framework for interpreting and analyzing the available information can be influenced disproportionately by an initial, default position or “anchor.” This anchor can be chosen in a variety of ways. For example, it may be based on initial information, prominent and vivid data, or recent data. Adjustments from the anchor tend to insufficiently incorporate new information. Availability is a cognitive bias that involves individuals giving undue weight to more accessible, readily recalled information.

For example, a management presentation describing specific successes or selecting favorable comparisons for business performance could anchor an analyst’s view of the business results as successful. Subsequent less favorable metrics or explanations might not be given the appropriate consideration or weight. Typically, management presentations and annual reports begin with a summary of results and achievements. Analysts should recognize the risk of this information being given undue importance in the analysis relative to the analyst’s own ratios and metrics.

The extent to which company management can be excessively optimistic is shown in Exhibit 9, which analyzes the report of a bank that subsequently moved into significant loss. Analysts reviewing a company report that lacks balance in the language need to consider the potential for their favorable initial impression of reporting language to adversely affect an objective analysis of numbers, via the influence of framing bias.

Exhibit 9 Framing Bias

Consider this text analysis of the chairman’s statement and business review in the 2007 annual report of a major European bank published in 2008, a few months before the bank was rescued by the government.

Occurrences of:			
Negative words		Positive words	
Disappoint/disappointed	0	Good	55
Bad/badly	0	Excellent	12
Poor	0	Success/successful	35
Weaker/weakening	7	Improvement	23
Slowdown	6	Strong/stronger/strongly	78

Source: Royal Bank of Scotland plc, Annual Report and Accounts 2007, SVM Analysis.

Analysts should also recognize the possibility of a self-attribution bias in company executives that arises from the impact of incentive compensation on company reporting. Incentive compensation for both company management and for analysts can be too large, creating errors of reasoning and judgment because of preoccupation with specific factors. Company management and analysts can be influenced by optimism. This optimism may be influenced by overconfidence and illusion of control biases. As a result, there is a systematic tendency to overestimate the likelihood of favorable outcomes, and underestimate the likelihood of negative events (Lench and Ditto 2008). Optimism can be evident in company reporting.

Framing and setting expectations may be influenced by companies presenting recalculated earnings. This recalculation may happen if management believes earnings are temporarily or artificially depressed; typically, the recalculation does not comply with generally agreed accounting practice presentation. Usually, the recalculated earnings are more favorable and given greater prominence in company reporting. Because these adjustments can affect valuation, apparent growth rates, and the smoothness of earnings progression (earnings quality), analysts need to consider whether the adjustment is unreasonably influencing their perception of the business in terms of profitability, growth, or riskiness.

5.2.1 Remedial Actions for Influence of Company's Management on Analysis

Analysts can best deal with cognitive biases in the interpretation of information by maintaining a disciplined and systematic approach. Focusing on metrics and comparable data, rather than what is descriptive or unverifiable, can assist forecast accuracy and consistency of approach across research. Calibration of likely accuracy can be improved by framing the issue appropriately, gathering information, and recognizing underlying base rates.

5.3 Analyst Biases in Conducting Research

Although cognitive biases may be the most significant behavioral problem for analysts, there is usually also an emotional component to judgment. Emotional responses are a significant factor in the real-time processing of financial information. Emotional perception of information is not necessarily rational; emotions can improve or disrupt decision making. However, even before an analysis is complete, the model or judgment can only be as good as the data used. The search process for information is an important element of successful analysis, and the optimal stopping point in that search may not be clear. It is possible to collect too much information.

Specific biases can be more prevalent in company analysis. Collecting too much unstructured information may not only lead to illusions of knowledge and control, contributing to overconfidence, but can also expose analysts to the risk of representativeness. Additional information can feed representativeness.

More detail collected from companies can feed confidence. An indicator that a conclusion has been driven by extraneous detail may be that the conclusion is presented as a *story*. A story involves explaining evidence with a story or scenario that fits, and then making a decision that matches the specific scenario. A story may not be based on a thorough analysis but can be compelling because of how it is presented.

Confirmation bias, a cognitive bias, is the tendency for people to misread evidence as additional support for an initial hypothesis. Confirmation bias is a form of resolving cognitive dissonance that describes the tendency to search for, or interpret, information in a way that confirms the analyst's prior beliefs. The additional information may not be analyzed in a rigorous way, but it can nevertheless appear to make the judgment or forecast more likely by sharing some of its general characteristics. An example is when probabilities of independent events are combined inappropriately, such as additively or some variation of adding, to support a belief. This example highlights the conjunction fallacy. The probability of two independent events occurring in conjunction is never greater than the probability of either event occurring alone. In fact, the probability of two independent events occurring together is equal to the multiplication of the probabilities of the independent events.

The **gamblers' fallacy**, a misunderstanding of probabilities in which people wrongly project reversal to a long-term mean, is a related cognitive bias (Shefrin 2007). Investment professionals, and strategists in particular, can suffer from this cognitive bias. It reflects a faulty understanding about the behavior of random events, expecting reversals to occur more frequently than actually happens. With the gamblers' fallacy,

the analyst is expecting a pattern that has diverged from the long-term average to reverse within a specific period of time. Another fallacy, common to gamblers and many others, is the hot hand fallacy. People affected by this fallacy wrongly project continuation of a recent trend. Both of these fallacies demonstrate a lack of understanding of statistical independence.

Similar to endowment bias, assets may be endowed with additional value based on an emotional response to them. Analysts can associate financially sound companies with good or safe characteristics, although the external economic environment or high stock price for the company can make it risky. This view can also reflect a confirmation bias. Analysts may look for and notice what confirms their beliefs, and ignore or undervalue what contradicts their beliefs. Studies have suggested that analysts have biases favoring growth over value. Earnings growth records themselves can be seen as representative of a growth business, and naively extrapolated. The tendency of analysts to recommend high-growth and low-yield stocks typically reflects a failure to incorporate the base rate or effect of the environment in which a company operates. This situation may reflect a **representativeness bias**.

EXAMPLE 4

Investment Manager Case Study

It is August. An investment manager has just signed a charitable organization (charity) as a new client. The charity currently holds primarily cash and liquid assets. The directors of the charity would like to move some money not required to fund short- or medium-term activities of the charity into stocks. They expect stocks to earn higher returns than the returns of the assets currently held. They have asked the investment manager to advise them on the timing of entry into the stock market.

The manager advises them that she expects stock to rise over the next 12 months but advises deferring investment in stocks for a month or two. She thinks stocks will decline in the near future because each month for the last six months stocks have risen more than the average monthly increase for the last 25 years. She anticipates a correction that will reduce the increase to the long-term average. She suggests waiting to enter the market until after the anticipated correction.

She states that the probability of a market fall in any September is 0.55 and that the probability of a market increase over a 12-month period is 0.7. She uses these probabilities to support her advice to defer investment for a month or two.

Assume that the probabilities are correct and that the events are independent. What behavioral biases might be evident with this advice? How might the investment manager address these?

Solution:

The expectation of a market reversal—a fall coming after a rising trend—could reflect the gamblers' fallacy. The investment manager is expecting the stocks that have diverged from the long-term average to reverse within a specific period of time. She has not done a thorough analysis but has instead told a compelling story. She may be susceptible to a representativeness bias, in which analysts judge the probability of a forecast being correct by considering how much the outcome resembles overall available data. Frequently, this simplification combines probabilities incorrectly. Additional information or detail may appear to conform to the overall scenario being forecast, even if it is largely irrelevant, and so add to confidence in the forecast. Further, the manager may be anchoring

incorrectly on the long-run average. If she believes in a further gain in the stock market, then phased investment over a period of weeks or months may reduce the impact of volatility on timing investment on any single day or month.

Combining this event—a stock market fall in September—with an expectation of a rise in subsequent months to support the manager's belief inappropriately combines probabilities and reflects the **conjunction fallacy**. The probability of two independent events occurring in conjunction is never greater than the probability of either event occurring alone. The probability of a market fall in September is 0.55, the probability of a market rise over the subsequent 12 months is 0.7, and the two events are independent. Therefore, the probability of the two events occurring in the outlined scenario is just 0.385 ($= 0.55 \times 0.7$). This probability is lower than the probability of either individual event. However, the investment manager and the client may suffer from a confirmation bias that makes the additional detail appear supportive of her belief. The information is not being analyzed in a rigorous way. Essentially, the proposal to the client is a sequence of apparently connected events (a story). The added detail in actuality suggests that the assumed scenario is less likely than she asserts, but offers misleading vividness and detail that is being misinterpreted.

5.3.1 Remedial Actions for Analyst Biases in Conducting Research

Given the errors and overconfidence in forecasts, analysts should focus on more objective data such as trailing earnings. However, even reported earnings may be affected by operating and accounting choices made by management. In making forecasts, analysts should *evaluate previous forecasts* and be wary of anchoring and adjustment.

Emotional biases are difficult to deal with and can impact the search process, thereby compromising any subsequent analysis. The solution is to *collect information in a systematic way* and, where possible, use metrics and ratios that allow comparability—comparability in both analysis with previous calculations and also, where possible, benchmarked against current similar calculations. Information should be questioned and assessed relative to its context. It is important when gathering information to use a *systematic approach* with prepared questions. Information should be gathered before analysis is done and a conclusion has been made. In conducting analysis, CFA Institute members and candidates are expected to comply with Standard V of the *Standards of Practice Handbook*.

An analyst should attempt to *assign probabilities*, particularly to underlying base rates of prevalence. It is a human failing to assume that some outcomes are either impossible or certain. Once base rates or events are assessed with other than 0 or 100 percent likelihood, a Bayesian approach to combining evidence will force the conclusion away from unlikely scenarios.

Analysts need to *consider the search process*, the limits of information, and the context of the information. A *structured process* for information gathering and processing can help analysts deal with search biases. A search process should involve *seeking contrary facts and opinions*. Online data gathering or news services can be set to provide information that avoids some search biases. Without structure in the search for information, it is possible for analysts simply to collect more confirmatory evidence while overlooking contradictory information. Clear unambiguous forecasts can help address this shortcoming; confirmatory bias may be greater with complex forecasts that can be easier to appear to confirm.

Having a structured search process and a clear way of *incorporating evidence sequentially*, either as decision rules (trees) or using Bayes' formula, can encourage much faster adaptation of forecasts. *Prompt feedback* not only allows re-evaluation but also helps analysts to gain knowledge and experience that can be drawn on in the future, either consciously or unconsciously (intuitively).

Identifying faulty searches or stories (an excess of representative but less relevant information) is difficult. However, experts' arguments should include some contrary evidence. In a report or forecast, this evidence may be introduced by the use of such words as "however" rather than words that simply reinforce a belief or conclusion, such as "moreover." Vivid and specific illustration in support of an argument may indicate representativeness and availability biases, whereas many good analysts' reports will admit to some abstract unknowns and admit some contrary evidence.

Although analysts should *document* their decision making to assist later evaluation, some of the documentation may be best done once the analysis is complete. Studies suggest that the process of providing explanations can diminish an expert's ability to draw on his or her intuition. Stories can also overwrite nuances and actual knowledge, and they may represent less creative solutions. The amount of knowledge that can be conveyed in a written or spoken answer is small compared with the store of knowledge and decision rules stored in one's head. Spoken and written language can encourage linear thinking, whereas actual decision making is a more complex weighting of different unconnected factors. The nuances of judgment can be hard to verbalize.

Remedial actions include using consistent data, evaluating previous forecasts, taking a systematic and structured approach, assigning probabilities, seeking contrary facts and opinions, incorporating evidence sequentially, having prompt feedback, and documenting the process.



"Superforecasting"

To combat biases, one must take a disciplined approach to decision making. A quantitative process often comes to mind—letting the emotionless computer drive the analysis, via the use of statistics or simulation. However, a program is only as robust as the programmers who wrote it. Human creativity, as outlined in *Superforecasting* (Tetlock and Gardner, 2015), and the qualitative route can be just as effective in achieving high-quality decisions. "Machines may get better at 'mimicking human meaning,' and thereby better at predicting human behavior, but 'there's a difference between *mimicking* and... *originating meaning*.' (p. 22)." Human beings still have the edge in terms of lateral thinking but to do so requires focus and commitment. Ultimately, pairing humans and computers, thus building on each other's strengths and mitigating each other's weaknesses, may offer the most robust long-term investment system.

6

HOW BEHAVIORAL FACTORS AFFECT COMMITTEE DECISION MAKING

Many investment decisions are made by groups or committees rather than by individuals acting alone. Examples include analyst stock recommendations that need to be approved by research committees and the asset allocation and fund manager selection decisions of a pension plan made by a board of trustees or some other group of fiduciaries. Often, the motivation for using a group decision is the idea that "two heads are better than one." More formally, the application to a task of a number of individuals, each with different skills and experiences, can be expected to allow for more effective decision making.

Individual decision making is affected by behavioral biases, and a variety of behavioral biases are relevant to investment decisions made by individuals whether they are private or professional investors. Individuals can be overconfident in their

information and their ability to forecast earnings or pick winning investments. They can be anchored by irrelevant values, such as past stock prices, or too conservative in updating beliefs in the face of new information, such as earnings forecasts. They can be loss averse and reluctant to close out a position at a loss, even if on an objective basis the future prospects of the investment have deteriorated. As we consider investment committee decision making, we need to evaluate the implications of these individual biases for group decision making. The group process may mitigate a bias or it may exacerbate it. We also need to consider whether the group decision-making process creates additional biases.

Analysts will often work with research teams, and the group environment can have an impact on their own research. Although this arrangement can set standards for good professional work, and provide a cultural and analytical framework for that work, individuals are subject to biases that can compromise their research.

Social proof is a bias in which individuals are biased to follow the beliefs of a group. Analysts may wrongly favor the judgment or endorsement of others, often without being fully aware that they are doing so. This behavior can adversely affect analytical work. For example, a buy-side analyst's investment view might be influenced by his or her team's investment position.

Groups may also amplify individual behavioral biases. The process of reaching a consensus will usually narrow the range of views. If a group-decision process does not encourage private information held by individual analysts to be shared fully with others before a decision is made, the decision may fail to combine the collective wisdom of the group. Group judgments are potentially better than individual ones, but biases mean that the group may not perform optimally. Typically, a group will have more confidence in its decisions after discussion that leads to an overconfidence bias.

6.1 Investment Committee Dynamics

All of the biases present in individuals can be present in investment committee decisions. A group environment may increase them. Wood (2006) cites an example in which his investment recommendation to a committee of a purchase of Ford Motor Company shares was rejected because of the chair's own poor experience with the company's products. Other committee members immediately supported and reinforced the chair's view despite it being based on weak anecdotal evidence:

... the rest of the committee chimed in to support the chair's verdict. Any disagreement with people in power is reflected by the Japanese proverb, "the nail that sticks up gets hammered down." Prior experience with group behavior teaches most members to preserve consensus or face the consequences. (p. 30)

There is little evidence in this instance of two heads being better than one. In essence, the committee merely acted to support the judgment of one head, the chair. In general, decision makers are most likely to learn to control harmful behavioral biases in situations where the decision makers have repeated attempts at the decision and there is good quality feedback on prior outcomes. It follows that investment committee decision making should be improved by carefully analyzing and learning from past decisions. Wood (2006) argues that this rarely happens, and changing committee membership is particularly unhelpful in this regard:

Committees notoriously do not learn from experience. Feedback is a learning mechanism, but feedback from most decisions, when available, is often slow and generally inaccurate. Committees rarely keep track of decisions

well enough or long enough to identify systematic biases that creep into their deliberations. Without feedback, people struggle to understand what works and what does not. (p. 32)

6.2 Techniques for Structuring and Operating Committees to Address Behavioral Factors

We might ask why the logic of “two heads are better than one” often fails to apply in committees in practice. Wood (2006) makes an important distinction between crowds and committees. A crowd is a random collection of individuals. For example, in the TV game show “Who Wants to Be a Millionaire?” contestants can opt to ask the studio audience to help identify the correct multiple choice answer to a question. The majority opinion of the audience (a crowd) has been correct 91 percent of the time (Surowiecki 2004). Most investment committees fall well short of a 91 percent hit rate.

The main difference is that crowds are diverse, with individuals having varied backgrounds and experiences. Furthermore, in situations like asking the audience, members of the crowd give their own best opinion without consulting, and thus potentially avoid being influenced by other crowd members. In contrast, committees are often made up of individuals with similar backgrounds who are likely to approach decisions in a similar way. Committee decisions are discussed and debated, and as a result, individuals may moderate their own views to fit in with the consensus or may feel pressure to agree with views expressed by powerful individuals on the committee. It follows that committee decision making is likely to be enhanced when a committee is made up of members from diverse backgrounds who are independent enough to express and support their own views rather than falling into line with the views of others. However, assembling and managing such diverse and opinionated committees is likely to be challenging.

The chair of a committee has an important role in ensuring the effectiveness of the committee’s decision making. As noted earlier, this responsibility includes assembling a diverse group of individuals with relevant skills and experiences and creating a culture in which members can express dissenting views. The chair is also responsible for ensuring that the committee sticks to the agenda and making sure a clear decision is reached after the various opinions have been heard. The chair should actively encourage alternative opinions so that all perspectives are covered. In turn, committee members have a responsibility to actively contribute their own information and knowledge and not simply fall into line with the consensus for the sake of harmony.

Teams that are diverse in skills, experience, and culture may be less prone to social proof bias. Different perspectives and contrary views are more likely to emerge in a diverse group. Ensuring professional respect between all members of the group and maintaining analysts’ self-esteem can help each member contribute to group judgment, even if the views expressed are contrary to group norms. An individual expressing strong contrarian views within the group can help in avoiding too quick of a move to consensus before all the evidence is discussed. The risk of suppressed privately held information by individuals can be reduced if a group leader collects some of the individual views in advance of a discussion.

HOW BEHAVIORAL FINANCE INFLUENCES MARKET BEHAVIOR

7

Much of the day-to-day work of investment professionals will be within the framework of efficient markets. This framework provides a useful set of tools for investment analysis, portfolio management, and risk management. Over time, academic papers have broadened the understanding of market efficiency. However, this understanding still does not explain some persistent market patterns. Behavioral finance does offer some explanation of these exceptions to market efficiency, and this reading focuses on the biases that contribute to these anomalies. Investment professionals should view an understanding of these biases as complementary to their knowledge of market efficiency, thus allowing a greater range of stock market and investor behavior to be explained.

7.1 Defining Market Anomalies

Efficient markets should not deliver abnormal returns. Research has documented a number of puzzles or persistent features of market behavior that appear to contradict the efficient markets hypothesis. On closer examination, not all necessarily contradict the efficient market hypothesis. Note that the hypothesis does not rule out small abnormal returns before fees and expenses are taken into account. Closed-end fund discounts, for example, typically do not offer a profitable strategy to trade when transaction costs are allowed for.

Anomalies (apparent deviations from the efficient market hypothesis) are identified by persistent abnormal returns that differ from zero and are predictable in direction. However, calculating what constitutes normal returns relative to the risk incurred depends on the asset pricing model used. Anomalous behavior can be indicative of shortcomings in the underlying asset pricing model. When high returns persist on a particular class of securities, or relative to a specific factor in valuation, it might simply be a compensation for excess risk rather than genuinely anomalous. Fama (1998) states that if a reasonable change in the method of estimating abnormal returns causes an anomaly to disappear, then it is reasonable to suggest that it is an illusion. He includes in this category apparently low returns following initial public offerings (called the “IPO puzzle”) and the positive abnormal returns apparent in the 12 months after a stock split.

Some apparent anomalies may be explained by the small samples involved, a statistical bias in selection or survivorship, or data mining that overanalyzes data for patterns and treats spurious correlations as relevant. The magnitude of any over- or underperformance depends critically on the choice of benchmark, which can make it hard to interpret results. The risk with data mining is that the anomaly may not persist out of sample. From 1967 to 1997, the Super Bowl indicator,⁹ a spurious correlation, correctly “predicted” the direction of two out of three US market indexes 27 out of 30 times. But it then indicated wrongly 4 times in a row, delivering an accurate result in just 7 out of the next 13 years. Since any correlation between the outcome of a sporting event and stock market performance cannot be rationally explained, it is not surprising that the Super Bowl indicator has turned out to be an inaccurate predictor.

Also, from time to time, markets can present *temporary disequilibrium behavior*, unusual features that may survive for a period of years but ultimately disappear. Publication of the anomaly, which draws attention to the pattern, can start the arbitrage

⁹ Supposedly if the winner of the United States’ National Football League Super Bowl comes from the NFC division, the stock market will increase for the coming year, and if the winner comes from the AFC division, the stock market will decrease for the coming year.

that removes the behavior. For example, the small company January effect, part of the turn-of-the-year effect, does not appear persistent once appropriate adjustment for risk is made. The weekend effect, involving lower stock market returns on Mondays, appears to have reduced in the United States and United Kingdom. However, the market anomalies discussed in this section reflect behavior that has been identified and analyzed in a number of markets around the world and at different time periods. The patterns have been documented in many academic studies, with broadly similar conclusions.

Some of these market features may be attributed to rational behavior that is not captured by accepted pricing models. Investor response to the effect of taxes might be an example of this issue. But for other patterns of questionable rationality, behavioral finance has provided good explanations by identifying persistent cognitive biases or emotional affect. In general, the biases that are harder to rectify are emotional, with cognitive biases typically being easier to correct. However, there is no single unified underlying model of investor psychology. Despite the challenges, the efficient market hypothesis provides a base from which anomalies can be identified, and against which specific cognitive biases can be measured.

7.2 Momentum

Studies have documented, in a range of markets globally, *momentum* or *trending effects* in which future price behavior correlates with that of the recent past (Jegadeesh and Titman 1993; Dimson, Marsh, and Staunton 2008). Typically in the short term, up to two years, there is a positive correlation, but for longer periods of two to five years returns are negatively correlated and revert to the mean.

Individual investors may make what they believe is a rational decision to imitate the decisions of others, but the sum of the individual decisions can be irrational behavior. This behavior may not necessarily lead to bubbles or crashes, but it could explain the fat tail distribution of stock market returns, in which extreme moves occur more frequently than a normal statistical distribution would predict. The phenomenon is more common in illiquid asset categories in which trading may not be continuous and investors believe that changes in prices may capture private information.

Herding occurs when a group of investors trade on the same side of the market in the same securities, or when investors ignore their own private information and act as other investors do. Herding reflects a low dispersion of opinion among investors about the interpretation of the information, and it may involve following the same sources of information. Herding may be a response to cognitive dissonance. It may give reassurance and comfort to investors to be aligned with the consensus opinion.

Exhibit 10 The Momentum Effect: London Business School Study

The study involves buying the top 20 percent of a performance-ranked list of stocks and selling short the bottom 20 percent. In the 52 years to 2007 in the UK market, the stocks that had outperformed the market most in the previous 12 months went on to generate an annualized return of 18.3 percent, whereas the market's worst underperformers rose by 6.8 percent on average. Over that period, the market as a whole rose by 13.5 percent a year. In a subsequent study using data from 2000 to 2007, the momentum effect was also evident in each of the 16 other international markets researched.

Exhibit 10 (Continued)

The authors noted “The momentum effect, both in the United Kingdom and globally, has been pervasive and persistent. Though costly to implement on a standalone basis, all investors need to be acutely aware of momentum. Even if they do not set out to exploit it, momentum is likely to be an important determinant of their investment performance.”

Source: Dimson, Marsh, and Staunton (2008).

Momentum can be partly explained by short-term underreaction to relevant information, and longer-term overreaction. Investors’ bias to sell winners reflects *anchoring* on the purchase price. Investors’ willingness to sell winners may also be the result of a belief that a price rise has brought increased risk, irrespective of whether intrinsic value has also increased. The belief in mean reversion can cause investors to underreact to positive news, and stock prices to take time to reflect fully more favorable news or earnings upgrades.

Studies have identified faulty learning models within traders, in which reasoning is based on their recent experience. Behaviorally, this is *availability bias*. The availability bias in this context is also called the *recency effect*, which is the tendency to recall recent events more vividly and give them undue weight. In such models, if the price of an asset rises for a period of time, investors may simply extrapolate this rise to the future. Recency bias causes investors to place too much emphasis on samples that are small or that provide an imperfect picture, but they are favored because the information is recently available. Research points to a tendency for individual private investors to extrapolate trends and to suffer more from recency bias, whereas many investment professionals expect reversion to the mean.

Regret is the feeling that an opportunity has been missed, and is typically an expression of *hindsight bias*. Hindsight bias reflects the human tendency to see past events as having been predictable, and regret can be particularly acute when the market is volatile and investors feel they could have predicted the significant market moves and thereby increased profit or reduced loss. Faced with regret at not owning a mutual fund or stock when it performed in the previous year, investors may be driven emotionally to remedy this regret. These behavioral factors can explain short-term year-on-year trending, and contribute to overtrading.

This response creates a *trend-chasing effect*. In terms of selecting investments, investors have a bias to buy investments they wish they had owned the previous year. This bias reflects the availability bias in projecting a recent trend, and also the innate human focus on searching for patterns, both true and illusory.

However, there is some evidence of price reversals, or a mean reversion, at longer periods of three to five years. The **disposition effect**, which includes an emotional bias to loss aversion, will encourage investors to hold on to losers, causing an inefficient and gradual adjustment to deterioration in fundamental value (Shefrin and Statman 1985). The disposition effect is emotional. Even investors who do not own a poorly performing stock, and are not thus emotionally affected by ownership, may be showing an irrational belief in short-term mean reversion in the form of a price recovery (*gamblers’ fallacy*).

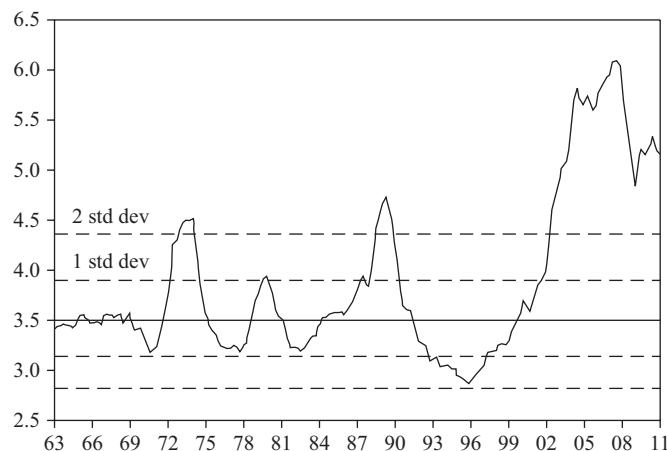
The disposition effect has been identified from trading records (Odean 1998). This research identified that investors with US discount brokerage accounts sold winners more readily than losers, a behavior consistent with the emotional bias of loss aversion and the cognitive bias of believing that their winners and losers will revert to the mean. Emotional biases and an irrational belief in mean reversion encourage market trending patterns.

7.3 Bubbles and Crashes

Stock market bubbles and crashes present a challenge to the concept of market efficiency. Periods of significant overvaluation or undervaluation can persist for more than one year, rather than rapidly correcting to fair value. The efficient market hypothesis implies the absence of such bubbles. The frequent emergence of bubbles in history was documented in *Extraordinary Popular Delusions and the Madness of Crowds* (Mackay 1841). The book captures the concept of extremes of sentiment and apparent mass irrationality. Bubbles and crashes appear to be panics of buying and selling. A continuous rise in an asset price is fueled by investors' expectations of further increase; asset prices become decoupled from economic fundamentals.

A more objective modern definition specifies periods when a price index for an asset class trades more than two standard deviations outside its historic trend. Statistically, if returns are normally distributed, such periods should not represent more than 5 percent of total observations. However, for some stock markets and asset classes, these extremes of valuation account for more than 10 percent.

Exhibit 11 UK House Price Average Multiple of Average Family Income



Source: Datastream.

Bubbles and crashes are, respectively, periods of unusual positive or negative asset returns because of prices varying considerably from or reverting to their intrinsic value. Typically during these periods, price changes are the main component of returns. Bubbles typically develop more slowly relative to crashes, which can be rapid. This asymmetry points to a difference in the behavioral factors involved. A crash would typically be a fall of 30 percent or more in asset prices in a period of several months. Some bubbles and crashes will reflect rapid changes in economic prospects that investors failed to anticipate. The global oil price shock of the 1970s and the Japanese asset price bubble of the late 1980s, in which real estate and stock prices rose dramatically, would be examples. Initially in a bubble, some participants may view the trading and prices as a rational response—for example, to easy monetary conditions or a liquidity squeeze—but this view is typically followed by doubts about whether prices reflect fundamental values.

These bubbles have been observed in most decades and in a wide range of asset classes. Recent examples are the technology bubble of 1999–2000 and the residential property boom of 2005–2007, evident in a range of economies globally including the United States, the United Kingdom, and Australia. They appear to be periods of

collective irrationality, but can be analyzed in more detail as representing some specific behavioral characteristics of individuals. Behavioral finance does not yet provide a full explanation for such market behavior, but a number of specific cognitive biases and emotional biases prevalent during such periods can be identified.

First, it should be noted that there can also be rational explanations for some bubbles. Rational investors may expect a future crash but not know its exact timing. For periods of time, there may not be effective arbitrage because of the cost of selling short, unwillingness of investors to bear extended losses, or simply unavailability of suitable instruments. These were considerations in the technology and real estate bubbles. Investment managers incentivized on, or accountable for, short-term performance may even rationalize their participation in the bubble in terms of commercial or career risk.

The extent to which investors may rationalize their behavior during bubbles is evident in Exhibit 12. Both managers appear to have misunderstood risks and exhibited the illusion of control bias. The manager of Fund A believed he could exit a bubble profitably by selling near the top. The manager of Fund B may not have recognized the potential scale of a bubble, or client perspectives on a period of relative under-performance while not participating in the bubble.

Exhibit 12 Investor Behavior in Bubbles

Consider the differing behavior of two managers of major hedge funds during the technology stock bubble of 1998–2000:

The manager of Hedge Fund A was asked why he did not get out of internet stocks earlier even though he knew by December 1999 that technology stocks were overvalued. “We thought it was the eighth inning, and it was the ninth. I did not think the NASDAQ composite would go down 33 percent in 15 days.” Faced with losses, and despite a previous strong 12-year record, he resigned as Hedge Fund A’s manager in April 2000.

The manager of Hedge Fund B refused to invest in technology stocks in 1998 and 1999 because he thought they were overvalued. After strong performance over 17 years, Hedge Fund B was dissolved in 2000 because its returns could not keep up with the returns generated by technology stocks.

In bubbles, investors often exhibit symptoms of *overconfidence*; overtrading, underestimation of risks, failure to diversify, and rejection of contradictory information. With overconfidence, investors are more active and trading volume increases, thus lowering their expected profits. For overconfident investors (active traders), studies have shown that returns are less than returns to either less active traders or the market while risk is higher (Barber and Odean 2000). At the market level, volatility also often increases in a market with overconfident traders.

The overconfidence and excessive trading that contribute to a bubble are linked to *confirmation bias* and *self-attribution bias*. In a rising market, sales of stocks from a portfolio will typically be profitable, even if winners are being sold too soon. Investors can have faulty learning models that bias their understanding of this profit to take personal credit for success. This behavior is also related to *hindsight bias*, in which individuals can reconstruct prior beliefs and deceive themselves that they are correct more often than they truly are. This bias creates the feeling of “I knew it all along.” Selling for a gain appears to validate a good decision in an original purchase and may confer a sense of pride in locking in the profit. This generates overconfidence that can lead to poor decisions. Regret aversion can also encourage investors to participate in a bubble, believing they are “missing out” on profit opportunities as stocks continue to appreciate.

Overconfidence involves an *illusion of knowledge*. Investors would be better off not trading on all the available information, which includes noise or non-relevant information. Asset prices provide a mix of information, both facts and the mood of the crowd. But in a stock market bubble, noise trading increases and overall trading volumes are high. Noise trading is buying and selling activity conducted in the absence of meaningful new information, and is often based on the flow of irrelevant information. A manager increasing trading activity in a rising stock market can misinterpret the profitability of activity, believing it is trading skill rather than market direction delivering profits.

The disposition effect recognizes that investors are more willing to sell winners, which can encourage excess trading. There can also be a confirmation bias to select news that supports an existing decision or investment. Indeed, search processes may focus almost exclusively on finding additional confirmatory information. Investors may be uncomfortable with contradictory information and reject it. Investors can also have a bias to buy stocks that *attract their attention*, and pay more attention to the market when it is rising. For short-term traders who may derive entertainment from the market, monitoring rising stock prices is more entertaining and instills more pride. Entertainment and pride are emotional effects.

As a bubble unwinds, there can be underreaction that can be caused by anchoring when investors do not update their beliefs sufficiently. The early stages of unwinding a bubble can involve investors in cognitive dissonance, ignoring losses and attempting to rationalize flawed decisions. As a bubble unwinds, investors may initially be unwilling to accept losses. In crashes, the disposition effect encourages investors to hold on to losers and postpone regret. This response can initially cause an underreaction to bad news, but a later capitulation and acceleration of share price decline. This situation will only apply to stocks already held by investors, with hedge funds that can sell stock short being more inclined to react first to bad news in a downturn. In crashes, there may be belief that short sellers know more and have superior information or analysis.

7.4 Value and Growth

A number of studies have identified outperformance of value stocks relative to growth stocks over long periods of time. Fama and French (1998) note that value stocks (high book-to-market equity) outperformed growth stocks (low book-to-market equity) in 12 of 13 major markets during the 1975–1995 period. Value stocks are typically characterized by low price-to-earnings ratios, high book-to-market equity, and low price-to-dividend ratios. Growth stock characteristics are generally the opposite of value stock characteristics. For example, growth stocks are characterized by low book-to-market equity, high price-to-earnings ratios, and high price-to-dividend ratios. Some subsequent studies have included additional factors, such as low price-to-cash flow and low historic growth, to characteristics of value stocks. Fama and French (1998) also identified that small-capitalization stocks outperformed large-cap stocks in 11 of 16 markets.

Fama and French incorporate additional factors in their asset pricing model to explain this anomaly and other apparent anomalies. The Fama and French (1992) three-factor model claims to explain these effects by incorporating additional factors, size and value, alongside market beta. Fama and French show that earnings and size variables capture much of the cross-sectional variation in US stock returns from 1963 to 1990, and this finding has also been documented for a number of non-US markets. Fama and French claim the value stock anomaly disappears in their three-factor model. They believe that the size and book-to-market effects are not mispricing, but are associated with such risk exposures as the greater potential of companies with these characteristics to suffer distress during economic downturns.

A number of other studies have offered behavioral explanations, presenting the anomalies as mispricing rather than risk. These studies recognize emotional factors involved in appraising stocks. The **halo effect**, for example, extends a favorable evaluation of some characteristics to other characteristics. A company with a good growth record and good previous share price performance might be seen as a good investment, with higher expected returns than its risk characteristics merit. This view is a form of representativeness that can lead investors to extrapolate recent past performance into expected returns. Overconfidence can also be involved in predicting growth rates, potentially leading growth stocks to be overvalued.

Studies have also identified that emotions play a role in estimating risk and expected return of stocks. The impact of emotional biases may be greater with less sophisticated or retail investors, but it has also been identified as a bias in analysts and professional investors. The emotional attraction of a stock can be enhanced by personal experience of products, the value of the brand, marketing expenditures, and the proximity of the headquarters to the analyst or investor. This last issue reflects the **home bias** anomaly, by which portfolios exhibit a strong bias in favor of domestic securities in the context of global portfolios. The effect has also been noted within geographical boundaries, favoring companies headquartered nearer the investor. This bias may reflect a perceived relative informational advantage, a greater feeling of comfort with the access to company executives that proximity brings (either personal or local brokerage), or a psychological desire to invest in a local community.

To the extent to which less sophisticated investors are influenced by emotions, they may value growth companies more highly. Statman, Fisher, and Anginer (2008) found that stock returns of funds that are rated as popular in a *Fortune* magazine survey are subsequently low. A more positive emotional rating in a company leads investors to perceive the company's stock as less risky. Although the capital asset pricing model assumes risk and expected return are positively correlated, many investors behave as if the correlation is negative, expecting higher returns with lower risk.

One behavioral theory set out by Shefrin (2008) recognizes the tendency of investors to need downside protection to avoid negatively skewed returns. This investor preference displays excessive risk relative to likely outcomes. Securities that embody significant downside risks in an adverse economic environment, therefore, reflect this risk aversion and offer a premium. An optimal portfolio, taking advantage of behavioral biases, would recognize the extent to which stocks reflect this risk aversion premium, and thus offer returns in excess of true risk. Writing (selling) out-of-the-money put options on securities or indexes would be one way to reflect this risk.

Some apparent anomalies disappear over time, possibly being arbitraged away. However, some anomalies persist and may genuinely reflect rational behavior that is not captured by accepted pricing models. The most persistent market anomalies and characteristics that challenge the efficient market hypothesis are the momentum effect and bubbles and crashes. These effects can be created by biases that cause underreactions at times but overreaction on other occasions. Although group behavior can be a factor in these market anomalies, the origins of many anomalies lie in individual biases. The biases that create some of the unusual market behavior include both cognitive biases and emotional effects.

SUMMARY

This reading includes suggestions on how to include behavioral considerations in financial decision making. The effects of including behavioral considerations in adviser-client relationships and portfolio construction are discussed. Finally, the reading considers

the effect of behavioral factors on analyst forecasts, committee decision making, and market behavior. It is important to remember that all market participants, regardless of expertise, may exhibit behavior that differs from that assumed in traditional finance. Among the points made in this reading are the following:

- Classifying investors into investor types based on their characteristics, including level of risk tolerance, preferred approach to investing, and behavioral characteristics and biases, is useful for providing insight and financial decision making but should be used with some caution.
- Adviser-client relations and financial decisions will be more effective and satisfying if behavioral factors are taken into account.
- Including behavioral factors in portfolio construction may result in a portfolio that is closer to the efficient portfolio of traditional finance, while being easier for the client to understand and accept as suitable. By considering behavioral biases, it is possible to moderate their effects.
- All market participants, even those with significant knowledge of and experience in finance, may exhibit behavioral biases. Analysts are not immune. Analysts, in general, are prone to overconfidence, representativeness, availability, illusion of control, and hindsight biases. Awareness of their biases and their potential influences can help analysts put in place measures to help moderate the effect of these biases.
- Analysts interpreting information provided by management should consider and adjust for the biases that analysts and management teams are typically susceptible to, including framing, anchoring and adjustment, availability, and overconfidence. Management biases can affect both the choice of information presented and how it is presented. These may have an effect on the analysis.
- Committees often have the responsibility for making investment decisions and are subject to behavioral biases. It is important to implement procedures to alleviate the effect of behavioral biases and improve committee decision making.
- Behavioral finance has the potential to explain some apparent deviations from market efficiency (market anomalies).

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PRACTICE PROBLEMS

The following information relates to Questions 1–7

Ian Wang, CFA, is a financial advisor at Garnier Brothers, a US money management firm. He became a financial advisor several years ago after receiving his CFA charter and currently has three high-net-worth individuals as clients. Wang is conducting his annual review of each client's investment policy statement along with their recently completed risk tolerance questionnaires. He is reflecting on their varying psychographic characteristics:

- Michael Perez is a successful 45-year-old investment banker. Wang describes Perez as a passive investor who is sensible and secure. Perez exhibits low to medium risk tolerance but often overestimates his risk tolerance. His biases include hindsight, framing, and regret aversion. On his questionnaire, Perez indicated a desire for wealth preservation while wanting to invest a significant portion of his assets in his employer's stock.
- Sarah Johnson is an independent-minded 45-year-old real estate developer who has historically utilized significant amounts of financial leverage. Prior to becoming a Garnier client, Johnson managed her own investment portfolio, which was concentrated in just a few stocks. Johnson exhibits a great deal of confidence and high risk tolerance. Johnson's biases include illusion of control and overconfidence. On her questionnaire, Johnson indicated a desire for wealth accumulation and an aversion to investing in non-US equities. In addition, she indicated that her risk tolerance toward a stock investment would increase significantly if she knew that more than one of Garnier's research analysts supported it.
- Neal Patel is a 66-year-old billionaire who accumulated his wealth by starting a successful retail business. Wang describes Patel as cautious and concerned about the future. Patel is concerned about protecting his assets and often seeks advice from those he perceives as being more knowledgeable than himself. Patel exhibits low risk tolerance. Patel's biases include endowment, loss aversion, and status quo. Patel indicated that his risk tolerance would increase significantly if he knew that an investment had the unanimous support of Garnier's Private Wealth Investment Committee.

There was one common observation that Wang noted in all three questionnaires: All three clients indicated that they would perceive a company with a good growth record and good previous share price performance as a good investment.

Once Wang completes his annual review, he revises the investment policy statement for the client's approval. After the client approves the revised policy statement, the portfolio for the client will be reviewed to determine any necessary reallocations. Wang is limited by Garnier as to the specific investment options that can be placed in a client's portfolio; only securities that are covered by Garnier's research analysts and approved by the Private Wealth Investment Committee can be placed in a client's portfolio. Garnier is confident that its analysts provide superior forecasts and ratings

because they use a Bayesian approach. Garnier is also proud of its investment approval process. The Private Wealth Investment Committee regularly meets to discuss and debate each security and then votes on which will be approved.

Wang is scheduled to meet with his supervisor next week to discuss the results of his annual review and recommended portfolio reallocations.

- 1 When advising his clients, Wang is *least likely* to:
 - A educate Perez on the benefits on portfolio diversification.
 - B limit Johnson's role in the investment decision-making process.
 - C provide Patel with details like standard deviations and Sharpe ratios.
- 2 A traditional risk tolerance questionnaire is *most likely* to be effective as a diagnostic tool for:
 - A Patel.
 - B Perez.
 - C Johnson.
- 3 Which of the following behavioral biases would be *most* relevant in constructing a portfolio for Johnson?
 - A Home bias.
 - B Overconfidence.
 - C Inertia and default.
- 4 Which investment portfolio is *least likely* to deviate from the mean–variance portfolio?
 - A Patel.
 - B Perez.
 - C Johnson.
- 5 With regard to Johnson's comment relating to Garnier's research analysts, which of the following biases is *most likely* to be present in the analysts' data?
 - A Confirmation bias.
 - B Availability bias.
 - C Self-attribution bias.
- 6 Patel's comment in his risk tolerance questionnaire regarding the Private Wealth Investment Committee fails to recognize which bias?
 - A Social proof.
 - B Confirmation bias.
 - C Gambler's fallacy.
- 7 The clients' common observation in their risk tolerance questionnaires is *least likely* indicative of:
 - A herding.
 - B home bias.
 - C halo effect.

The following information relates to Questions 8–15

Empire & Associates, an investment management firm, has been in operation since 1974. Empire utilizes a proprietary valuation model based on fundamental analysis to select individual stock and bonds, and also employs technical analysis to help identify market anomalies and momentum effects. They use the output of their fundamental and technical analyses to actively manage clients' accounts. Empire also recognizes the effects of investors' background and past experiences on investors' behaviors and decision making, and uses a behavioral alpha process to classify its clients into behavioral investor types.

Anthony Rodriguez, investment adviser, has been tasked with transitioning three new clients' investment portfolios. Rodriguez has reviewed for each completed new client questionnaire, current portfolio, and some notes on the client. He prepares the following summaries:

- Christine Blake is a 35-year old free-lance writer of several successful children's books. Her primary source of income is royalty payments. She has accumulated a portfolio with a current value of \$3.6 million. Blake has always self-managed the portfolio and has confidence in her investment abilities. Blake would like to be able to make independent decisions when opportunities arise. On several occasions, Blake has found herself holding positions with sizable losses and she has been reluctant to sell when a security declines. Because of these losses and the general size of her portfolio, she is seeking professional help. She is willing to consider higher risk investments if her research identifies an attractive opportunity. Her current portfolio consists of 15 equity positions of equal dollar value, diversified across eight industries and four different countries.
- Margaret Neilson is a 59-year-old senior vice president of marketing for a highly successful, plastic injection corporation. Neilson has little investment experience and currently holds an \$800,000 investment portfolio. Neilson has come to Empire because 80% of her portfolio is invested in the plastic injection corporation's shares that were obtained through an employee stock ownership plan. Neilson is nearing retirement and is worried about a weakening economy and the potential effect it could have on the plastic injection corporation's share price. Neilson wishes to avoid high risk situations.
- Thomas Williamson is a 47-year-old surgeon; he is considered one of the world's best in his specialty, and earns several million dollars each year. Williamson recognizes that he has limited investment expertise and considers himself a low to moderate risk taker. Williamson established a brokerage account several years ago and funded it with \$4 million. He has made no withdrawals from and no additional payments into the account. He selected investments by acting on the advice of other doctors and friends. This advice led him to purchase many popular stocks, and his portfolio is currently worth \$3.55 million. Because he was so busy, he felt he mistimed buying and selling stocks. His current portfolio is concentrated in shares of eight US healthcare companies.

Rodriguez is meeting with Ian Carter, portfolio manager and Lila Suzuki, investment strategist, later in the week to establish an investment plan for each client. Rodriguez has worked with Carter and Suzuki on other client accounts. To facilitate discussion at the meeting, Rodriguez has emailed the summary on each client and asked that they provide some preliminary views prior to the meeting.

Carter is a senior portfolio manager with an excellent performance record. He has expressed concern about the use of investor type classification models due to their many limitations. Carter believes that Empire's fundamental approach to analysis provides great value. However, he believes the technical analysis department is compatible with sound investment practices.

Suzuki tends to rigidly adhere to asset selections based on the proprietary valuation model. She has stated, "Sure it's a complex model, but it incorporates hundreds of different pieces of data relevant to a company; therefore, it's more thorough than any other analysis." With respect to Empire's technical analysis, Suzuki believes that the identified opportunities are not 'true' market anomalies but rather they are associated with higher risk exposures.

In establishing the portfolios for these new accounts, Rodriguez would like to address a recent memo from the technical analysis department that recommended overweighting clients' portfolios in the technology and consumer goods sectors. The memo's conclusion stated, "These sectors are depressed below their ten-year average levels. Every time that this has occurred in the past, these sectors have recovered to their mean in a short period of time." Rodriguez believes that technical analysis has the potential to uncover opportunities where there are over- or under-reactions to relevant information.

- 8** Which new client would most likely be identified as a friendly follower?
 - A** Blake.
 - B** Neilson.
 - C** Williamson.
- 9** Carter's statement regarding behavioral classifications is *most likely* justified because individual investors generally:
 - A** exhibit characteristics of multiple investor types.
 - B** retain the same emotional biases as they become older.
 - C** exhibit primarily emotional or cognitive biases, but not both.
- 10** Given Neilson's behavioral investor characteristics, the *most* effective approach in advising her would include providing her with:
 - A** frequent reports of the portfolio return and risk measures.
 - B** information detailing how Empire selects individual securities.
 - C** information about how Empire will help her meet her investment goals.
- 11** Blake's portfolio would *most likely* indicate which behavioral bias?
 - A** Home bias.
 - B** Loss aversion.
 - C** Investing in the familiar.
- 12** Suzuki's rigid adherence to the proprietary valuation model *most likely* exhibits overconfidence in Empire's fundamental analysis due to:
 - A** availability bias.
 - B** self-attribution bias.
 - C** an illusion of control.
- 13** The recent technical analysis memo is *most likely* evidence of:
 - A** anchoring.
 - B** a confirmation bias.
 - C** the gambler's fallacy.
- 14** Blake's portfolio *least likely* reflects:

- A home bias.
B a disposition effect.
C naïve diversification.
- 15 Whose statement regarding the technical analysis department is most accurate?
- A Carter.
B Suzuki.
C Rodriguez.
-

The following information relates to Questions 16–18

Ravi King is an advisor with an investment management company that classifies all investors into one of four Behavioral Investor Types (BITs): Passive Preserver (PP), Friendly Follower (FF), Independent Individualist (II), or Active Accumulator (AA). King prepares for a meeting with Amélie Chan, a client who exhibits moderate risk tolerance.

King believes that Chan's prior investment choices are consistent with her BIT. In their last meeting one year ago, Chan expressed an interest in owning shares of a small, local startup company that she had heard about from friends. King explained the high level of risk associated with that investment idea, and Chan agreed that he should not buy the shares for her account.

King recommended that Chan instead invest in shares of another company, Avimi S.A. The investment management company's data-backed research report suggested that the Avimi shares were undervalued. Chan agreed with King's recommendation, and King bought shares of Avimi for Chan's account.

King will meet with Chan tomorrow and present the investment management company's updated research report on Avimi. The report justifies his belief that the shares are now overvalued, and he will recommend that Chan sell her Avimi shares.

- 16 Determine the BIT *most likely* to be assigned to Chan. Justify your response.
-

Determine the BIT *most likely* to be assigned to Chan.
(circle one)

Passive Preserver Friendly Follower Independent Individualist Active Accumulator

Justify your response.

- 17 Determine whether Chan will *most likely* hold or sell the Avimi shares after meeting with King tomorrow. Justify your response.
-

**Determine whether Chan will *most likely* hold or sell the Avimi shares after meeting with King tomorrow.
(circle one)**

Hold	Sell
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Justify your response.

King prepares for a meeting with Lani Mikaele, a client who founded a successful, fast-growing business that has made her wealthy. Unlike many other clients, Mikaele is very involved in the decision-making process with King. She calls King often to suggest purchasing and selling positions, resulting in a higher turnover rate relative to other clients.

At a business lunch last year, King recommended that Mikaele purchase shares of Withrow Inc., which has high growth potential but pays no dividends. Following their discussion, Mikaele was enthusiastic about the potential returns, so she followed King's recommendation and bought Withrow shares.

18 Determine the BIT *most likely* to be assigned to Mikaele. Justify your response.

**Determine the BIT (PP, FF, II, AA) *most likely* to be assigned to Mikaele.
(circle one)**

Passive Preserver	Friendly Follower	Independent Individualist	Active Accumulator
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Justify your response.

The following information relates to Questions 19 and 20

Anicée Ly is a portfolio manager for a bank and prepares for meetings with two new clients. Based on a completed risk tolerance questionnaire, Ly concludes that the first client, Rufus Olssen, is moderately risk averse with a mental accounting bias. Olssen desires capital growth with a small amount of income. Ly presents Olssen with the following two portfolios:

- Portfolio 1 100% in a global balanced fund that is mean–variance optimized.
- Portfolio 2 25% in CDs, 25% in a global bond index fund, 35% in a global equity index fund, and 15% in a high-risk, actively managed, micro-cap equity fund.

Both portfolios provide the same level of income and expected return, and the portfolios have the same Sharpe ratio.

- 19 Determine**, assuming Ly's bias conclusion is correct, which portfolio Olssen would *most likely* select. **Justify** your response.

Determine, assuming Ly's bias conclusion is correct, which portfolio Olssen would *most likely* select.
(circle one)

Portfolio 1

Portfolio 2

Justify your response.

The second client, Verochka Calderón, gives Ly a list of the four highest-performing funds in her defined contribution plan and asks Ly to recommend an allocation. After Calderón completes a risk tolerance questionnaire, Ly determines that Calderón likely exhibits framing and regret biases. Using the four funds, Ly suggests two allocations, presented in Exhibit 1.

Exhibit 1 Suggested Defined Contribution Plan Allocations

	Allocation A	Allocation B
Fund 1	25%	50%
Fund 2	25%	30%
Fund 3	25%	10%
Fund 4	25%	10%
Sharpe Ratio	0.40	0.40

- 20 Determine**, assuming Ly's determination of Calderón's biases is correct, which portfolio Calderón would *most likely* select. **Justify** your response.

Determine, assuming Ly's determination of Calderón's biases is correct, which portfolio Calderón would *most likely* select.
(circle one)

Allocation A

Allocation B

Justify your response.

- 21** Ariane Pineda is chair of the investment committee for a Canadian investment management company. She is seeking to replace a retiring committee member. Pineda actively encourages each committee member to share his or her views and privately held information as part of the decision-making process. Exhibit 1 presents the current committee members' characteristics.

Exhibit 1 Characteristics of Current Investment Committee Members

Committee Member	Age (years)	Department	Tenure with Firm (years)	Tenure on Committee (years)
1	53	Equity	29	16
2	57	Equity	22	17
3	64	Fixed Income	26	19
4	71	Fixed Income	41	22

Pineda gathers information on three potential candidates to fill the committee position.

- 1** Candidate A, 46, recently joined the company. She has worked in the alternative investments departments of three portfolio management companies in Asia and Canada.
- 2** Candidate B, 54, has worked in the company's headquarters for his entire career. He has held several investment management positions in the equity and fixed income departments.
- 3** Candidate C, 58, has worked for the company for eight years. Prior to joining the company, she worked as the chief accountant for a medium-sized local business group.

Recommend the *best* candidate for the investment committee position. **Justify** your response.

**Recommend the best candidate for the investment committee position.
(circle one)**

Candidate A	Candidate B	Candidate C
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Justify your response.

SOLUTIONS

- 1 C is correct. This would not be an effective way to advise Patel. Given Patel's information, he is likely to be more receptive to "big picture" advice that does not dwell on details like standard deviations and Sharpe ratios. He is emotionally biased and providing excessive cognitive detail will lose his attention. He needs to be convinced of his advisor's general philosophy first and then, as trust is gained, he will respond to advice and take action. (Patel is a Passive Preserver.)
- 2 B is correct. Perez exhibits primarily cognitive rather than emotional biases. Although risk tolerance questionnaires may fail for emotionally biased individuals and work best for institutional investors, they are generally effective for cognitive-based individuals.
- 3 A is correct. Home bias is evident in Johnson's questionnaire. Johnson has expressed an aversion to investing in non-US equities. Familiarity with their country may lead investors to own high concentrations of domestic assets and ignore the benefits of international diversification.
- 4 B is correct. Perez has primarily cognitive error biases. Accordingly, it is likely that, with education, the impact of these biases can be reduced or even eliminated. Because cognitive biases dominate, Wang should seek to moderate the effect of these biases and adopt a program to reduce or eliminate the bias rather than accept the bias. The result will be a portfolio that is similar to the mean-variance portfolio.
- 5 A is correct. Confirmation bias, a cognitive bias, is the tendency for people to misread evidence as additional support for an initial hypothesis. Confirmation bias is a potential bias for analysts conducting research. It is a form of resolving cognitive dissonance that described the tendency to search for, or interpret, information in a way that confirms the analyst's prior beliefs. The additional information may not be analyzed in a rigorous way, but it can nevertheless appear to make the judgment or forecast more likely by sharing some of its general characteristics.
- 6 A is correct. Social proof is a belief in which individuals are biased to follow the beliefs of a group. The structure of Garnier's Private Wealth Investment Committee indicates that they may be susceptible to a social proof bias. The committee meets to discuss and debate each security and then votes on which will be approved. Committee members may wrongly favor the judgment of others, often without being fully aware that they are doing so. The process of reaching a consensus will usually narrow the range of views. If a group decision process does not encourage private information held by individual committee members to be shared fully with others before a decision is made, the decision may fail to combine the collective wisdom of the group. There is no evidence that this committee encourages private information.
- 7 B is correct. Home bias occurs when investors exhibit a strong bias in favor of domestic securities in the context of global portfolios. There is no evidence of a home bias in the clients' common observation.
- 8 C is correct. Friendly followers are passive investors with low to moderate risk tolerance. Friendly followers tend to follow leads from their friends, colleagues, or advisors. They often want to be in the latest, most popular investments without regard to suitability for long-term goals. Rodriguez's notes indicate

Williamson considers himself to be a low to moderate risk taker. In addition, he admits following the advice of colleagues and this advice resulted in purchase of latest, popular stocks without consideration of goals.

- 9 A is correct. A limitation of behavioral models is that individual investors do frequently exhibit characteristics of multiple investor types. This is a limitation of behavioral models and justifies Carter's concern. Users of these models should not look for people to fit neatly into one "box" or type.
- 10 C is correct. Neilson would be classified as a guardian or passive-preserved investment type and these investors are more receptive to "big picture" advice. Passive preservers display predominantly emotional biases and the focus of advice should be on addressing these emotions. Describing how the investment relationship will help her to accomplish her retirement goals would seem most appropriate.
- 11 B is correct. Loss aversion is a bias in which people tend to strongly prefer avoiding losses as opposed to achieving gains. The disposition effect, which includes an emotional bias to loss aversion, will encourage investors to hold on to losers, causing an inefficient and gradual adjustment to deterioration in fundamental value. On several occasions, Blake has found herself holding positions with sizable losses, and she has been reluctant to sell when a security declines. This suggests that Blake may exhibit loss aversion bias.
- 12 C is correct. An illusion of control is a behavioral bias of someone who believes that he or she can know more than others simply by acquiring information. This may result in collection of too much information. While this data may not add to the accuracy of the forecast, it does reinforce the confidence placed in that forecast. Suzuki's endorsement of the complex valuation model which relies on large amounts of data most likely would give her an illusion of control.
- 13 C is correct. The gambler's fallacy is a cognitive behavioral bias in which an analyst wrongly projects a reversal to a long-term trend. This reflects a faulty understanding about the behavior of random events. The analyst expects a pattern that has diverged from the long term average to reverse within a specific period of time. The memo's statement that technology and consumer goods sectors should rebound within a short time period demonstrates the gamble's fallacy.
- 14 A is correct. Home bias occurs when an investor exhibits an emotional attraction to a stock that may be enhanced by the proximity of the headquarters to the investor. This creates portfolios that show strong bias in favor of domestic equities in the context of global portfolios. Blake's portfolio is diversified among four different countries and therefore would not indicate a home bias.
- 15 C is correct. Momentum can be partly explained by short-term under-reaction to relevant information, and longer term over-reaction and thus supports Rodriguez's view that the technical analysis department has value.

16

**Determine the BIT most likely to be assigned to Chan.
(circle one)**

Passive Preserver	Friendly Follower	Independent Individualist	Active Accumulator
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Justify your response.

- Chan is most likely to be classified as a Friendly Follower (FF).
- Chan exhibits moderate risk tolerance.

- Chan tends to follow leads from her friends and advisor when making investment decisions.
- Chan complied with the professional investment advice backed by data-backed research reports, so she agreed with King's recommendation to purchase Avimi shares.
- The FF can often overestimate his or her risk tolerance, as Chan did when she wanted King to invest in the high-risk small, local startup company.
- The FF may follow "hot" ideas and show availability bias, as Chan did when she wanted to King to buy shares of the small, local startup company.

Chan is most likely to be classified as a Friendly Follower. This type of passive investor exhibits moderate risk tolerance and tends to follow leads from his friends, colleagues, or advisors when making investment decisions. The FF generally complies with professional investment advice supported by data-backed research reports, and Chan agrees with King's recommendation to invest in Avimi.

The FF often overestimates his or her risk tolerance, as Chan did when she suggested an investment in the small, local startup company, which King determined had a high level of risk. Chan sought to follow a "hot" investment idea and showed availability bias when she sought to own shares of the small, local startup company because she had learned of this investment idea from her friends.

17

Determine whether Chan will *most likely* hold or sell the Avimi shares after meeting with King tomorrow.
(circle one)

Hold

Sell

Justify your response.

- Chan will most likely sell the Avimi shares.
- Chan tends to follow the lead of her advisor when making investment decisions.
- Chan will likely follow the sell recommendation because it is supported by the investment management company's updated research report.

Chan is likely to follow King's professional recommendation and sell the Avimi shares. Chan is most likely to be classified as a Friendly Follower (FF), and this investor type tends to follow the leads of friends and investment advisors when making investment decisions.

Data-backed research reports tend to help the FF better understand the implications of his or her investment choices. One year ago, King's presentation of the investment management company's research report helped Chan decide to buy the Avimi shares. Now, the investment management company's updated research report is likely to help persuade Chan to sell her shares.

18

Determine the BIT (PP, FF, II, AA) *most likely* to be assigned to Mikaele.
(circle one)

Passive Preserver

Friendly Follower

Independent Individualist

Active Accumulator

Justify your response.

- Mikaele is most likely to be classified as an Active Accumulator (AA).
- Mikaele is actively involved in the investment decision-making process.
- Mikaele exhibits a high risk tolerance as evidenced by her founding of a successful fast-growing business.
- Mikaele has a high net worth resulting from the success of her business, a characteristic of the AA.
- Mikaele's account exhibits a high turnover rate relative to other clients.

Mikaele is most likely to be classified as an Active Accumulator (AA). She is heavily involved in the investment management process. Mikaele exhibits a high-risk tolerance, evidenced by her founding a successful fast-growing business, and has accumulated significant wealth. Additionally, Mikaele's account has a relatively high turnover rate. These are all characteristics of an AA.

19

**Determine, assuming Ly's bias conclusion is correct, which portfolio Olssen would *most likely* select.
(circle one)**

Portfolio 1	Portfolio 2
-------------	-------------

Justify your response.

- Olssen would most likely select Portfolio 2.
- A mental accounting bias suggests that Olssen might consider his investments in layers.
- Portfolio 2 has the same income, expected return, and Sharpe ratio as Portfolio 1 and is structured in layers.

The results of the risk tolerance questionnaire suggest that Olssen exhibits a mental accounting bias. He likely compartmentalizes his portfolio into discrete layers of low-risk assets versus risky assets without regard to the correlations among the assets. Portfolio 2 is constructed in this way, with discrete layers for each objective, while Portfolio 1 is constructed to be mean–variance optimized. As a result, Olssen would most likely select Portfolio 2, particularly because it has the same income, expected return, and Sharpe ratio as Portfolio 1.

20

**Determine, assuming Ly's determination of Calderón's biases is correct, which portfolio Calderón would *most likely* select.
(circle one)**

Allocation A	Allocation B
--------------	--------------

Justify your response.

- Calderón would most likely select Allocation A.
- As a result of a framing bias, Calderón is likely to choose an allocation based on a 1/n naïve diversification strategy.
- As a result of a regret bias, Calderón is likely to choose a conditional 1/n strategy to minimize any potential future regret from one of her funds outperforming another.

Calderón would most likely select Allocation A. Ly believes that Calderón exhibits framing and regret biases. Framing bias may lead an investor such as Calderón to use a 1/n naïve diversification strategy, dividing contributions equally among available funds regardless of the underlying composition of the funds. Given Calderón's selection of the four highest-performing funds in her

plan, Calderón can minimize any potential future regret if one fund outperformed another by using a conditional $1/n$ diversification strategy, investing equally in all four funds. The Sharpe ratios of the two portfolios are the same, so this ratio does not influence the decision to select one allocation over the other.

21

**Recommend the best candidate for the investment committee position.
(circle one)**

Candidate A	Candidate B	Candidate C
-------------	-------------	-------------

Justify your response.

- Candidate A is the best candidate for the investment committee.
- Candidate A alone has expertise in Alternative Investments, which would complement the experience of those on the committee.
- Candidate A has international experience, another diversifying characteristic that may add fresh ideas.
- Her career at three other companies should enable her to express independent opinions and reduce the likelihood of her having a social proof bias.
- Because she is younger than the other committee members, Candidate A may have different perspectives that could add value to the committee.
- Pineda's leadership style of seeking all privately held information from each committee member means that Candidate A's ideas would likely be considered.

The best candidate for the investment committee position is Candidate A. She has worked in Alternative Investments, has international experience, and would offer a different perspective from the current members. Her experience with three other companies and the fact that she recently joined the investment management company reduce the chance of her being subject to a social proof bias. Candidate A is younger than the committee members and may have fresh ideas. Thus, Candidate A can be expected to add independent ideas to the committee's deliberations, and Pineda's leadership style increases the likelihood that her views will be heard and considered.

Although Candidate B has experience in both the Equity and Fixed Income departments, he may be susceptible to a social proof bias. Although Candidate C has worked for an outside firm in accounting, her experience would be less relevant to the investment committee than that of Candidate A.

PORFOLIO MANAGEMENT STUDY SESSION

4

Capital Market Expectations

A necessary task in the investment management process is to formulate capital market expectations. These forecasts of risk and return for various asset classes form the basis for constructing portfolios that maximize expected return for given levels of risk.

This study session examines the process of setting capital market expectations and covers major tools of economic analysis. A central theme of both readings is that a disciplined approach to setting expectations will be rewarded. After outlining a framework for developing expectations and reviewing potential pitfalls, the first reading focuses on the use of macroeconomic analysis in setting expectations. The second reading in this session builds on that foundation to examine setting expectations for specific asset classes—fixed income, equities, real estate, and currencies.

READING ASSIGNMENTS

- | | |
|-------------------|--|
| Reading 10 | Capital Market Expectations, Part I: Framework and Macro Considerations
by Christopher D. Piros, PhD, CFA |
| Reading 11 | Capital Market Expectations, Part II: Forecasting Asset Class Returns
by Christopher D. Piros, PhD, CFA |

READING

10

Capital Market Expectations, Part 1: Framework and Macro Considerations

by Christopher D. Piros, PhD, CFA

Christopher D. Piros, PhD, CFA (USA).

LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. discuss the role of, and a framework for, capital market expectations in the portfolio management process;
<input type="checkbox"/>	b. discuss challenges in developing capital market forecasts;
<input type="checkbox"/>	c. explain how exogenous shocks may affect economic growth trends;
<input type="checkbox"/>	d. discuss the application of economic growth trend analysis to the formulation of capital market expectations;
<input type="checkbox"/>	e. compare major approaches to economic forecasting;
<input type="checkbox"/>	f. discuss how business cycles affect short- and long-term expectations;
<input type="checkbox"/>	g. explain the relationship of inflation to the business cycle and the implications of inflation for cash, bonds, equity, and real estate returns;
<input type="checkbox"/>	h. discuss the effects of monetary and fiscal policy on business cycles;
<input type="checkbox"/>	i. interpret the shape of the yield curve as an economic predictor and discuss the relationship between the yield curve and fiscal and monetary policy;
<input type="checkbox"/>	j. identify and interpret macroeconomic, interest rate, and exchange rate linkages between economies.

1

INTRODUCTION

A noted investment authority has written that the “fundamental law of investing is the uncertainty of the future.”¹ Investors have no choice but to forecast elements of the future because nearly all investment decisions look toward it. Specifically, investment decisions incorporate the decision maker’s expectations concerning factors and events believed to affect investment values. The decision maker integrates these views into expectations about the risk and return prospects of individual assets and groups of assets.

This reading’s focus is **capital market expectations** (CME): expectations concerning the risk and return prospects of asset classes, however broadly or narrowly the investor defines those asset classes. Capital market expectations are an essential input to formulating a strategic asset allocation. For example, if an investor’s investment policy statement specifies and defines eight permissible asset classes, the investor will need to have formulated long-term expectations concerning each of those asset classes. The investor may also act on short-term expectations. Insights into capital markets gleaned during CME setting should also help in formulating the expectations concerning individual assets that are needed in security selection and valuation.

This is the first of two readings on capital market expectations. A central theme of both readings is that a disciplined approach to setting expectations will be rewarded. With that in mind, Section 2 of this reading presents a general framework for developing capital market expectations and alerts the reader to the range of problems and pitfalls that await investors and analysts in this arena. Section 3 focuses on the use of macroeconomic analysis in setting expectations. The second of the two CME readings builds on this foundation to address setting expectations for specific asset classes: equities, fixed income, real estate, and currencies. Various analytical tools are reviewed as needed throughout both readings.

2

FRAMEWORK AND CHALLENGES

In this section, we provide a guide to collecting, organizing, combining, and interpreting investment information. After outlining the process, we turn to a discussion of typical problems and challenges to formulating the most informed judgments possible.

Before laying out the framework, we must be clear about what it needs to accomplish. The ultimate objective is to develop a set of projections with which to make informed investment decisions, specifically asset allocation decisions. As obvious as this goal may seem, it has important implications.

Asset allocation is the primary determinant of long-run portfolio performance.² The projections underlying these decisions are among the most important determinants of whether investors achieve their long-term goals. It thus follows that it is vital to get the long-run *level* of returns (approximately) right. Until the late 1990s, it was standard practice for institutional investors to extrapolate historical return data into forecasts. At the height of the technology bubble,³ this practice led many to project double-digit portfolio returns into the indefinite future. Such inflated

¹ Peter L. Bernstein in the foreword to Rapaport and Mauboussin (2001), p. xiii.

² See Brinson, Hood, and Beebower (1986) and Ibbotson and Kaplan (2000).

³ Explosive growth of the internet in the late 1990s was accompanied by soaring valuations for virtually any internet-related investment. The NASDAQ composite index, which was very heavily weighted in technology stocks, nearly quintupled from 1997 to early 2000, then gave up all of those gains by mid-2002. A variety of names have been given to this episode including the tech or technology bubble.

projections allowed institutions to underfund their obligations and/or set unrealistic goals, many of which have had to be scaled back. Since that time, most institutions have adopted explicitly forward-looking methods of the type(s) discussed in our two CME readings, and return projections have declined sharply. Indeed, as of the beginning of 2018, consensus rate of return projections seemed to imply that US private foundations, which must distribute at least 5% of assets annually, could struggle to prudently generate long-run returns sufficient to cover their required distributions, their expenses, and inflation. To reiterate, projecting a realistic overall level of returns has to be a top priority.

As appealing as it is to think we could project asset returns with precision, that idea is unrealistic. Even the most sophisticated methods are likely to be subject to frustratingly large forecast errors over relevant horizons. We should, of course, seek to limit our forecast errors. We should not, however, put undue emphasis on the precision of projections for individual asset classes. Far more important objectives are to ensure internal consistency across asset classes (**cross-sectional consistency**) and over various time horizons (**intertemporal consistency**). This emphasis stems once again from the primary use of the projections—asset allocation decisions. Inconsistency across asset classes is likely to result in portfolios with poor risk–return characteristics over any horizon, whereas intertemporal inconsistency is likely to distort the connection between portfolio decisions and investment horizon.

Our discussion adopts the perspective of an analyst or team responsible for developing projections to be used by the firm's investment professionals in advising and/or managing portfolios for its clients. As the setting of explicit capital market expectations has become both more common and more sophisticated, many asset managers have adopted this centralized approach, enabling them to leverage the requisite expertise and deliver more consistent advice to all their clients.

2.1 A Framework for Developing Capital Market Expectations

The following is a framework for a disciplined approach to setting CME.

- 1 *Specify the set of expectations needed, including the time horizon(s) to which they apply.* This step requires the analyst to formulate an explicit list of the asset classes and investment horizon(s) for which projections are needed.
- 2 *Research the historical record.* Most forecasts have some connection to the past. For many markets, the historical record contains useful information on the asset's investment characteristics, suggesting at least some possible ranges for future results. Beyond the raw historical facts, the analyst should seek to identify and understand the factors that affect asset class returns.
- 3 *Specify the method(s) and/or model(s) to be used and their information requirements.* The analyst or team responsible for developing CME should be explicit about the method(s) and/or model(s) that will be used and should be able to justify the selection.
- 4 *Determine the best sources for information needs.* The analyst or team must identify those sources that provide the most accurate and timely information tailored to their needs.
- 5 *Interpret the current investment environment using the selected data and methods, applying experience and judgment.* Care should be taken to apply a common set of assumptions, compatible methodologies, and consistent judgments in order to ensure mutually consistent projections across asset classes and over time horizons.

- 6 *Provide the set of expectations needed, documenting conclusions.* The projections should be accompanied by the reasoning and assumptions behind them.
- 7 *Monitor actual outcomes and compare them with expectations, providing feedback to improve the expectations-setting process.* The most effective practice is likely to synchronize this step with the expectations-setting process, monitoring and reviewing outcomes on the same cycle as the projections are updated, although several cycles may be required to validate conclusions.

The first step in the CME framework requires the analyst to define the universe of asset classes for which she will develop expectations. The universe should include all of the asset classes that will typically be accorded a distinct allocation in client portfolios. To put it another way, the universe needs to reflect the key dimensions of decision making in the firm's investment process. On the other hand, the universe should be as small as possible because even pared down to minimum needs, the expectations-setting process can be quite challenging.

Steps 2 and 3 in the process involve understanding the historical performance of the asset classes and researching their return drivers. The information that needs to be collected mirrors considerations that defined the universe of assets in step 1. The more granular the classification of assets, the more granular the breakdown of information will need to be to support the investment process. Except in the simplest of cases, the analyst will need to slice the data in multiple dimensions. Among these are the following:

- Geography: global, regional, domestic versus non-domestic, economic blocs (e.g., the European Union), individual countries;
- Major asset classes: equity, fixed-income, real assets;
- Sub-asset classes:
 - Equities: styles, sizes, sectors, industries;
 - Fixed income: maturities, credit quality, securitization, fixed versus floating, nominal or inflation-protected;
 - Real assets: real estate, commodities, timber.

How each analyst approaches this task depends on the hierarchy of decisions in their investment process. One firm may prioritize segmenting the global equity market by Global Industry Classification Standard (GIC) sector, with geographic distinctions accorded secondary consideration, while another firm prioritizes decisions with respect to geography considering sector breakdowns as secondary.⁴

In Step 3, the analyst needs to be sensitive to the fact that both the effectiveness of forecasting approaches and relationships among variables are related to the investor's time horizon. As an example, a discounted cash flow approach to setting equity market expectations is usually considered to be most appropriate to long-range forecasting. If forecasts are also to be made for shorter, finite horizons, intertemporal consistency dictates that the method used for those projections must be calibrated so that its projections converge to the long-range forecast as the horizon extends.

Executing the fourth step—determining the best information sources—requires researching the quality of alternative data sources and striving to fully understand the data. Using flawed or misunderstood data is a recipe for faulty analysis. Furthermore, analysts should be alert to new, superior data sources. Large, commercially available databases and reputable financial publications are likely the best avenue for obtaining widely disseminated information covering the broad spectrum of asset classes and geographies. Trade publications, academic studies, government and central bank

⁴ There is extensive literature on the relative importance of country versus industry factors in global equity markets. Marcelo, Quiros, and Martins (2013) summarized the evidence as "vast and contradictory."

reports, corporate filings, and broker/dealer and third-party research often provide more specialized information. Appropriate data frequencies must be selected. Daily series are of more use for setting shorter-term expectations. Monthly, quarterly, or annual data series are useful for setting longer-term CME.

The first four steps lay the foundation for the heart of the process: the fifth and sixth steps. Monitoring and interpreting the economic and market environment and assessing the implications for relevant investments are activities the analyst should be doing every day. In essence, step five could be labelled “implement your investment/research process” and step six could be labelled “at designated times, synthesize, document, and defend your views.” Perhaps what most distinguishes these steps from the day-to-day investment process is that the analyst must make simultaneous projections for all asset classes and all designated, concrete horizons.

Finally, in step 7 we use experience to improve the expectations-setting process. We measure our previously formed expectations against actual results to assess the level of accuracy the process is delivering. Generally, good forecasts are:

- unbiased, objective, and well researched;
- efficient, in the sense of minimizing the size of forecast errors; and
- internally consistent, both cross-sectionally and intertemporally.

Although it is important to monitor outcomes for ways in which our forecasting process can be improved, our ability to assess the accuracy of our forecasts may be severely limited. A standard rule of thumb in statistics is that we need at least 30 observations to meaningfully test a hypothesis. Quantitative evaluation of forecast errors in real time may be of limited value in refining a process that is already reasonably well constructed (i.e., not subject to obvious gross errors). Hence, the most valuable part of the feedback loop will often be qualitative and judgmental.

EXAMPLE 1

Capital Market Expectations Setting: Information Requirements

Consider two investment strategists charged with developing capital market expectations for their firms, John Pearson and Michael Wu. Pearson works for a bank trust department that runs US balanced separately managed accounts (SMAs) for high-net-worth individuals. These accounts' mandates restrict investments to US equities, US investment-grade fixed-income instruments, and prime US money market instruments. The investment objective is long-term capital growth and income. In contrast, Wu works for a large Hong Kong SAR-based, internationally focused asset manager that uses the following types of assets within its investment process:

Equities	Fixed Income	Alternative Investments
Asian equities	Eurozone sovereign	Eastern European
Eurozone	US government	venture capital
US large-cap		New Zealand timber
US small-cap		US commercial real
Canadian large-cap		estate

Wu's firm runs SMAs with generally long-term time horizons and global tactical asset allocation (GTAA) programs. Compare and contrast the information and knowledge requirements of Pearson and Wu.

Guideline answer:

Pearson's in-depth information requirements relate to US equity and fixed-income markets. By contrast, Wu's information requirements relate not only to US and non-US equity and fixed-income markets but also to three alternative investment types with non-public markets, located on three different continents. Wu has a more urgent need to be current on political, social, economic, and trading-oriented operational details worldwide than Pearson. Given their respective investment time horizons, Pearson's focus is on the long term whereas Wu needs to focus not only on the long term but also on near-term disequilibria among markets (for GTAA decisions). One challenge that Pearson has in US fixed-income markets that Wu does not face is the need to cover corporate and municipal as well as government debt securities. Nevertheless, Wu's overall information and knowledge requirements are clearly more demanding than Pearson's.

2.2 Challenges in Forecasting

A range of problems can frustrate analysts' expectations-setting efforts. Expectations reflecting faulty analysis or assumptions may cause a portfolio manager to construct a portfolio that is inappropriate for the client. At the least, the portfolio manager may incur the costs of changing portfolio composition without any offsetting benefits. The following sections provide guidance on points that warrant special caution. The discussion focuses on problems in the use of data and on analyst mistakes and biases.

2.2.1 Limitations of Economic Data

The analyst needs to understand the definition, construction, timeliness, and accuracy of any data used, including any biases. The time lag with which economic data are collected, processed, and disseminated can impede their use because data that are not timely may be of little value in assessing current conditions. Some economic data may be reported with a lag as short as one week, whereas other important data may be reported with a lag of more than a quarter. The International Monetary Fund sometimes reports data for developing economies with a lag of two years or more. Older data increase the uncertainty concerning the current state of the economy with respect to that variable.

Furthermore, one or more official revisions to initial data values are common. Sometimes these revisions are substantial, which may give rise to significantly different inferences. Often only the most recent data point is revised. Other series are subject to periodic "benchmark revisions" that simultaneously revise all or a portion of the historical data series. In either case—routine updating of the most recent release or benchmark revision—the analyst must be aware that using revised data as if it were known at the time to which it applies often suggests strong historical relationships that are unreliable for forecasting.

Definitions and calculation methods change too. For example, the US Bureau of Labor Statistics (BLS) made significant changes to the Consumer Price Index for All Urban Consumers (CPI-U) in 1983 (treatment of owner-occupied housing) and again in 1991 (regression-based product quality adjustments). Analysts should also be aware that suppliers of economic and financial indexes periodically **re-base** these indexes, meaning that the specific period used as the base of the index is changed. Analysts should take care to avoid inadvertently mixing data relating to different base periods.

2.2.2 Data Measurement Errors and Biases

Analysts need to be aware of possible biases and/or errors in data series, including the following:

- **Transcription errors.** These are errors in gathering and recording data.
- **Survivorship bias.** This bias arises when a data series reflects only entities that survived to the end of the period. Without correction, statistics from such data can be misleading. Data on alternative assets such as hedge funds are notorious for survivorship bias.
- **Appraisal (smoothed) data.** For certain assets without liquid public markets, notably but not only real estate, appraisal data are used in lieu of transaction data. Appraised values tend to be less volatile than market-determined values. As a result, measured volatilities are biased downward and correlations with other assets tend to be understated.

2.2.3 The Limitations of Historical Estimates

Although history is often a helpful guide, the past should not be extrapolated uncritically. There are two primary issues with respect to using historical data. First, the data may not be representative of the future period for which an analyst needs to forecast. Second, even if the data are representative of the future, statistics calculated from that data may be poor estimates of the desired metrics. Both of these issues can be addressed to some extent by imposing structure (that is, a model) on how data is presumed to have been generated in the past and how it is expected to be generated in the future.

Changes in technological, political, legal, and regulatory environments; disruptions such as wars and other calamities; and changes in policy stances can all alter risk–return relationships. Such shifts are known as changes in **regime** (the governing set of relationships) and give rise to the statistical problem of **nonstationarity** (meaning, informally, that different parts of a data series reflect different underlying statistical properties). Statistical tools are available to help identify and model such changes or turning points.

A practical approach for an analyst to decide whether to use the whole of a long data series or only part of it involves answering two questions.

- 1 Is there any reason to believe that the entirety of the sample period is no longer relevant? In other words, has there been a fundamental regime change (such as political, economic, market, or asset class structure) during the sample period?
- 2 Do the data support the hypothesis that such a change has occurred?

If the answer to both questions is yes, the analyst should use only that part of the time series that appears relevant to the present. Alternatively, he may apply statistical techniques that account for regime changes in the past data as well as the possibility of subsequent regime changes. Exhibit 1 illustrates examples of changes in regime.

Exhibit 1 Regimes and the Relevance of Historical Bond Returns

In the 1970s, oil price shocks combined with accommodative monetary policy by the US Federal Reserve fueled sharply rising inflation. In 1980, the Fed abruptly shifted to an aggressively tight stance. After the initial shock of sharply higher interest rates, US bond yields trended downward for roughly 35 years as the Fed kept downward pressure on inflation. Throughout the 1980s and 1990s, the Fed eased monetary policy in the aftermath of the technology bubble. Then, switching to an extraordinarily expansionary policy in the midst of the 2008–2009

(continued)

Exhibit 1 (Continued)

global financial crisis, the Fed reduced its policy rate to 0% in December 2008. Subsequently, it aggressively bought Treasury bonds and mortgage-backed securities. The Fed finally raised its policy rate target in December 2015. In October 2017, it stopped rolling over maturing bonds, allowing its balance sheet to shrink, albeit very slowly. It can be argued that bond returns from the 1970s through 2015 reflect at least three distinct regimes: the inflationary 1970s with accommodative Fed policy, the 1980–2008 period of disinflationary policy and secularly falling yields, and the unprecedented 2009–2015 period of zero interest rates and explosive liquidity provision. As of mid-2018, nominal interest rates were still negative in some developed markets, and major central banks including the Fed were aiming to “normalize” policy over the next few years. There is ample reason to believe that future bond returns will reflect a regime like none before.

In general, the analyst should use the longest data history for which there is reasonable assurance of stationarity. This guideline follows from the fact that sample statistics from a longer history are more precise than those with fewer observations. Although it is tempting to assume that using higher-frequency data (e.g., monthly rather than annual observations) will also provide more-precise estimates, this assumption is not necessarily true. Although higher-frequency data improve the precision of sample variances, covariances, and correlations, they do *not* improve the precision of the sample mean.

When many variables are considered, a large number of observations may be a statistical necessity. For example, to calculate a sample covariance matrix, the number of observations must exceed the number of variables (assets). Otherwise, some asset combinations (i.e., portfolios) will spuriously appear to have zero volatility. This problem arises frequently in investment analysis, and a remedy is available. Covariance matrices are routinely estimated even for huge numbers of assets by assuming that returns are driven by a smaller set of common factors plus uncorrelated asset-specific components.

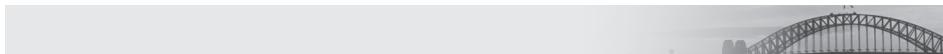
As the frequency of observations increases, the likelihood increases that data may be asynchronous (i.e., not simultaneous or concurrent in time) across variables. This means that data points for different variables may not reflect exactly the same period even though they are labeled as if they do. For example, daily data from different countries are typically asynchronous because of time zone differences. Asynchronicity can be a significant problem for daily, and perhaps even weekly data, because it distorts measured correlations and induces lead–lag relationships that might not exist if the data were measured synchronously. Lower-frequency data (e.g., monthly or quarterly) are less susceptible to asynchrony, although it can still arise. For example, two series that are released and labeled as monthly could reflect data collected at different times of the month.

As a final note on historical data, some care should be taken with respect to whether data are normally distributed. Historical asset returns, in particular, routinely exhibit skewness and “fat tails,” which cause them to fail formal tests of normality. The cost in terms of analytical complexity of accounting for non-normality, however, can be quite high. As a practical matter, the added complexity is often not worth the cost.⁵

⁵ See Chapter 5 of Stewart, Piros, and Heisler (forthcoming 2019) for discussion of the effect of alternative probability distributions on asset allocation decisions.

2.2.4 *Ex Post* Risk Can Be a Biased Measure of *Ex Ante* Risk

In interpreting historical prices and returns over a given sample period, the analyst needs to evaluate whether asset prices reflected the possibility of a very negative event that did not materialize during the period. This phenomenon is often referred to as the “peso problem.” Looking backward, we are likely to underestimate *ex ante* risk and overestimate *ex ante* anticipated returns. The key point is that high *ex post* returns that reflect fears of adverse events that did not materialize provide a poor estimate of *ex ante* expected returns.



The 1970s Peso Devaluation

In the mid-1970s, the Mexican peso was pegged to the US dollar, but peso-denominated interest rates were persistently well above corresponding dollar rates because investors feared the Mexican government would devalue the peso. In 1976, the peso was indeed devalued by nearly 50%, but data from before that event would suggest that holding the peso was a high expected return, low risk strategy.

The opposite situation is also a problem, especially for risk measures that consider only the subset of worst-case outcomes (e.g., value at risk, or VaR). If our data series includes even one observation of a rare event, we may substantially overstate the likelihood of such events happening in the future. Within a finite sample, the observed frequency of this bad outcome will far exceed its true probability. As a simple example, there were 21 trading days in July 2018. On 26 July, the price of Facebook stock closed down 19%. Based on this sample, the (interpolated) daily 5% VaR on Facebook stock is 17.3%. That is, an investor in Facebook shares would expect to lose at least 17.3% once every 20 days.

2.2.5 *Biases in Analysts' Methods*

Analysts naturally search for relationships that will help in developing better capital market expectations. Among the preventable biases that the analyst may introduce are the following:

- **Data-mining bias** arises from repeatedly searching a dataset until a statistically significant pattern emerges. It is almost inevitable that some relationship will appear. Such patterns cannot be expected to have predictive value. Lack of an explicit economic rationale for a variable's usefulness is a warning sign of a data-mining problem: no story, no future.⁶ Of course, the analyst must be wary of inventing the story after discovering the relationship and bear in mind that correlation does not imply causation.
- **Time-period bias** relates to results that are period specific. Research findings often turn out to be sensitive to the selection of specific starting and/or ending dates.

⁶ See McQueen and Thorley (1999).

Small Cap Outperformance and Time-Period Bias

Evidence suggesting that small-cap stocks outperform large-cap stocks over time (the so-called small firm effect) is very sensitive to the choice of sample period. From 1926 through 1974, US small-cap stocks outperformed large caps by 0.43% per year, but if we skip the Great Depression and start in 1932, the differential becomes 3.49% per year. Similarly, small caps outperformed by 3.46% per year from 1975 through 2016 but by only 0.09% per year from 1984 through 2016. In the nine years from 1975 through 1983, small caps outperformed by 16.85% per year!⁷

How might analysts avoid using an irrelevant variable in a forecasting model? The analyst should scrutinize the variable selection process for data-mining bias and be able to provide an economic rationale for the variable's usefulness in a forecasting model. A further practical check is to examine the forecasting relationship out of sample (i.e., on data that was not used to estimate the relationship).

2.2.6 The Failure to Account for Conditioning Information

The discussion of regimes introduced the notion that assets' risk and return characteristics vary with the economic and market environment. That fact explains why economic analysis is important in expectation setting. The analyst should not ignore relevant information or analysis in formulating expectations. Unconditional forecasts, which dilute this information by averaging over environments, can lead to misperception of prospective risk and return. Exhibit 2 illustrates how an analyst may use conditioning information.

Exhibit 2 Incorporating Conditioning Information

Noah Sota uses the CAPM to set capital market expectations. He estimates that one asset class has a beta of 0.8 in economic expansions and 1.2 in recessions. The expected return on the market is 12% in an expansion and 4% in a recession. The risk-free rate is assumed to be constant at 2%. Expansion and recession are equally likely. Sota aims to calculate the unconditional expected return for the asset class.

The conditional expected returns on the asset are $10\% = 2\% + 0.8 \times (12\% - 2\%)$ in an expansion and $4.4\% = 2\% + 1.2 \times (4\% - 2\%)$ in a recession. Weighting by the probabilities of expansion and recession, the unconditional expected return is $7.2\% = [(0.5 \times 10\%) + (0.5 \times 4.4\%)]$.

EXAMPLE 2

Ignoring Conditioning Information

Following on from the scenario in Exhibit 2, one of Noah Sota's colleagues suggests an alternative approach to calculate the unconditional expected return for the asset class. His method is to calculate the unconditional beta to be used in the CAPM formula, $1.0 = (0.5 \times 0.8) + (0.5 \times 1.2)$. He then works out the unconditional expected return on the market portfolio, $8\% = (0.5 \times 12\%) +$

⁷ Source: Ibbotson Associates database (Morningstar). Returns calculated by the author.

$(0.5 \times 4\%)$. Finally, using the unconditional beta and the unconditional market return, he calculates the unconditional expected return on the asset class as $8.0\% = 2.0\% + 1.0 \times (8\% - 2\%)$.

Explain why the alternative approach is right or wrong.

Guideline answer

The approach suggested by Sota's colleague is wrong. It ignores the fact that the market excess return and the asset's beta vary with the business cycle. The expected return of 8% calculated this way would overestimate the (unconditional) expected return on this asset class. Such a return forecast would ignore the fact that the beta differs for expansion (0.8) and recession (1.2).

2.2.7 Misinterpretation of Correlations

When a variable A is found to be significantly correlated with another variable B , there are at least four possible explanations: (1) A predicts B , (2) B predicts A , (3) a third variable C predicts both A and B , or (4) the relationship is spurious. The observed correlation alone does not allow us to distinguish among these situations. Consequently, correlation relationships should not be used in a predictive model without investigating the underlying linkages.

Although apparently significant correlations can be spurious, it is also true that lack of a strong correlation can be misleading. A negligible measured correlation may reflect a strong but *nonlinear* relationship. Analysts should explore this possibility if they have a solid reason for believing a relationship exists.

2.2.8 Psychological Biases

The behavioral finance literature documents a long and growing list of psychological biases that can affect investment decisions. Only a few of the more prominent ones that could undermine the analyst's ability to make accurate and unbiased forecasts are outlined here. Furthermore, note that the literature contains various names and definitions of behavioral biases, which are not necessarily mutually exclusive.

- **Anchoring bias** is the tendency to give disproportionate weight to the first information received or first number envisioned, which is then adjusted. Such adjustment is often insufficient, and approximations are consequently biased. Analysts can try to avoid anchoring bias by consciously attempting to avoid premature conclusions.
- **Status quo bias** reflects the tendency for forecasts to perpetuate recent observations—that is, to avoid making changes and preserve the status quo, and/or to accept a default option. This bias may reflect greater pain from errors of commission (making a change) than from errors of omission (doing nothing). Status quo bias can be mitigated by disciplined effort to avoid “anchoring” on the status quo.
- **Confirmation bias** is the tendency to seek and overweight evidence or information that confirms one's existing or preferred beliefs and to discount evidence that contradicts those beliefs. This bias can be mitigated by examining all evidence with equal rigor and/or debating with a knowledgeable person capable of arguing against one's own views.
- **Overconfidence bias** is unwarranted confidence in one's own intuitive reasoning, judgment, knowledge, and/or ability. This bias may lead an analyst to overestimate the accuracy of her forecasts and/or fail to consider a sufficiently broad range of possible outcomes or scenarios. Analysts may not only fail to fully account for uncertainty about which they are aware (sometimes described

as “known unknowns”) but they also are very likely to ignore the possibility of uncertainties about which they are not even aware (sometimes described as “unknown unknowns”).

- **Prudence bias** reflects the tendency to temper forecasts so that they do not appear extreme or the tendency to be overly cautious in forecasting. In decision-making contexts, one may be too cautious when making decisions that could damage one’s career or reputation. This bias can be mitigated by conscious effort to identify plausible scenarios that would give rise to more extreme outcomes and to give greater weight to such scenarios in the forecast.
- **Availability bias** is the tendency to be overly influenced by events that have left a strong impression and/or for which it is easy to recall an example. Recent events may likewise be overemphasized. The effect of this bias can be mitigated by attempting to base conclusions on objective evidence and analytical procedures.

EXAMPLE 3

Biases in Forecasting and Decision Making

Cynthia Casey is a London-based investment adviser with a clientele of ultra-high-net-worth individuals in the UK, the US, and the EU. Within the equity portion of her portfolios, she rarely deviates significantly from the country weightings of the MSCI World Index, even though more often than not she tilts the allocation in the right direction. Hence, she can claim a good tactical track record despite having added little value in terms of return through tactical allocation. Because most investors have an implicit “home bias,” her European clients tend to view their portfolios as significantly overweight the US (nearly 50% of the World index) and are happy because the US market outperformed the MSCI World ex-US Index by about 4% per year over the 10 years ending September 2018. Conversely, her US clients are unhappy because Casey persistently projected US outperformance but maintained what they instinctively perceive as a significant underweight in the United States. Citing year-to-date performance as of 28 September 2018—US up 9%, World ex-US down 1%, with 10 of 15 European markets down in local currencies—Casey’s US clients are pressuring her to aggressively increase allocations to US equities. Although experience has taught her to be wary of chasing a strong market, Casey vividly remembers losing clients in the late 1990s because she doubted that the explosive rally in technology stocks would be sustained. With that in mind, she has looked for and found a rationale for a bullish view on US stocks—very robust year-to-date earnings growth.

What psychological biases are Casey and her clients exhibiting?

Guideline answer

Casey’s clients are implicitly anchoring their expectations on the performance of their respective domestic markets. In pressing Casey to increase the allocation to US stocks based on recent outperformance, her US clients are clearly projecting continuation of the trend, a status quo bias. Casey herself is exhibiting several biases. Prudence bias is apparent in the fact that she has a good record of projecting the correct direction of relative performance among markets but has not translated that into reallocations large enough to add meaningful value. We cannot assess whether that bias affects the magnitude of her forecasts, the extent to which she responds to the opportunities, or both. Losing clients when she doubted the sustainability of the late 1990s technology rally made a very strong

impression on Casey, so much so that she has apparently convinced herself to look for a reason to believe the recent relative performance trends will persist. This is indicative of availability bias. Searching for evidence to support a favored view (continued strength of the US market) is a clear sign of confirmation bias, whereas finding support for that view in the recent strength of earnings growth reflects status quo bias.

2.2.9 Model Uncertainty

The analyst usually encounters at least three kinds of uncertainty in conducting an analysis. **Model uncertainty** pertains to whether a selected model is structurally and/or conceptually correct. **Parameter uncertainty** arises because a quantitative model's parameters are invariably estimated with error. **Input uncertainty** concerns whether the inputs are correct. Any or all of these may give rise to erroneous forecasts and/or cause the unwary analyst to overestimate the accuracy and reliability of his forecasts.

The effects of parameter uncertainty can be mitigated through due attention to estimation errors. Input uncertainty arises primarily from the need to proxy for an unobservable variable such as "the market portfolio" in the CAPM. Whether or not this is a serious issue depends on the context. It is a problem if the analyst wants to test the validity of the underlying theory or identify "anomalies" relative to the model. It is less of an issue if the analyst is merely focused on useful empirical relationships rather than proof of concept/theory. Model uncertainty is potentially the most serious issue because the wrong model may lead an analyst to fundamentally flawed conclusions.

Our discussion of the limitations of historical data touched on a model that led many investors far astray in the late 1990s. Up to that point, the implicit model used by many, if not most, institutional investors for setting long-term equity expectations was, "The *ex ante* expected return is, was, and always will be a constant number μ , and the best estimate of that number is the mean over the longest sample available." As the market soared in the late 1990s, the historical estimate of μ rose steadily, leading investors to shift more heavily into equities, which fueled further price appreciation and more reallocation toward equities, and so on, until the technology bubble burst. Ironically, belief in the sanctity of historical estimates coincided with the diametrically opposed notion that the "new economy" made historical economic and market relationships obsolete. There seemed to be no limits to growth or to valuations, at least in some segments of the market. But, of course, there were. This description of the technology bubble illustrates the breakdown of a particular forecasting model. It is not a literal description of anyone's thought process. For various reasons, however—competitive pressures, status quo/availability/prudence biases—many investors acted *as if* they were following the model.

Another flawed model unraveled during the global financial crisis of 2007–2009. One component of that model was the notion that housing price declines are geographically isolated events: There was no risk of a nationwide housing slump. A second component involved "originate to sell" loan pipelines: businesses that made loans with the intention of immediately selling them to investors and therefore had very little incentive to vet loan quality. A third component was the notion that the macro risk of an ever-growing supply of increasingly poor-quality mortgages could be diversified away by progressive layers of securitization. End investors were implicitly sold the notion that the securities were low risk because numerous computer simulations showed that the "micro" risk of individual loans was well diversified. The macro risk of a housing crisis, however, was not reflected in prices and yields—until, of course, the model proved to be flawed. The scenario highlighted here provides another illustration of a particular model breaking down. In this case, it was a flawed model of risk and diversification, and its breakdown was one of many aspects of the financial crisis.

3

ECONOMIC AND MARKET ANALYSIS

The previous section outlined various pitfalls in forecasting. Each of these is important. Yet they pale in comparison to a fundamental mistake: losing sight of the fact that investment outcomes are inherently linked to the economy. The technology bubble and the global financial crisis offer two extreme illustrations of the consequences of falling into this trap. Less dramatic, but still consequential, instances of this mistake regularly contribute to the differential investment performance that separates “winners” and “losers.” The remainder of this reading is dedicated to effective incorporation of economic and market analysis into capital market expectations.

3.1 The Role of Economic Analysis

History has shown that there is a direct yet variable relationship among actual realized asset returns, expectations for future asset returns, and economic activity. Analysts need to be familiar with the historical relationships that empirical research has uncovered concerning the direction, strength, and lead–lag relationships between economic variables and capital market returns.

The analyst who understands which economic variables may be most relevant to the current economic environment has a competitive advantage, as does the analyst who can discern or forecast changes in acceleration and deceleration of a trend.

Economic output has both cyclical and trend growth components. Trend growth is of obvious relevance for setting long-term return expectations for asset classes such as equities. Cyclical variation affects variables such as corporate profits and interest rates, which are directly related to asset class returns and risk. In the following sections, we address trend growth, business cycles, the role of monetary and fiscal policies, and international interactions.

3.2 Analysis of Economic Growth

The economic growth trend is the long-term average growth path of GDP around which the economy experiences semi-regular business cycles. The analyst needs to understand and analyze both the trend and the cycles. Though each could exist without the other, they are related.

It might seem that trends are inherently easier to forecast than cycles. After all, trends are about long-term averages, whereas cycles are about shorter-term movements and turning points. The assumption that trends are easier to forecast would be true if trend growth rates were constant. But trend growth rates do change, which is what makes forecasting them relevant for investment analysis. Some changes are fairly easy to forecast because they are driven by slowly evolving and easily observable factors such as demographics. Trend changes that arise from significant “exogenous shocks” to underlying economic and/or market relationships are not only impossible to foresee but also difficult to identify, assess, and quantify until the change is well-established and retrospectively revealed in the data. Virtually by definition, the effect of truly exogenous shocks on the level and/or growth rate of the economy will not have been built into asset prices in advance—although the risk of such events will likely have been reflected in prices to some degree.

3.2.1 Exogenous Shocks to Growth

Shocks arise from various sources. Some are purely domestic. Others are transmitted from other parts of the globe. Some are negative for potential growth, while others enhance it. Significant shocks typically arise from the following:

- **Policy changes.** Elements of pro-growth government policies include sound fiscal policy, minimal intrusion on the private sector, encouraging competition within the private sector, support for infrastructure and human capital development, and sound tax policies. Any significant, unexpected change in these policies that is likely to persist will change the expected trend rate of growth. The overhaul of US business taxes at the end of 2017, although not entirely unexpected, was intended to be a pro-growth change in policy. On the other hand, standard economic arguments indicate that erecting trade barriers will diminish trend growth.
- **New products and technologies.** Creation and assimilation of new products, markets, and technologies enhances potential growth. Consider the printing press, steam engine, telegraph and telephone, railroad, automobile, airplane, transistor, random-access memory (RAM), integrated circuits, internet, wireless communication (radio, TV, smartphone), rockets, and satellites, to name just a few.
- **Geopolitics.** Geopolitical conflict has the potential to reduce growth by diverting resources to less economically productive uses (e.g., accumulating and maintaining weapons, discouraging beneficial trade). The fall of the Berlin wall, which triggered German reunification and a “peace dividend” for governments as they cut defense spending, was a growth-enhancing geopolitical shock. Interestingly, geopolitical tensions (e.g., the space race) can also spur innovation that results in growth-enhancing technologies.
- **Natural disasters.** Natural disasters destroy productive capacity. In the short run, a disaster is likely to reduce growth, but it may actually enhance long-run growth if old capacity is replaced with more efficient facilities.
- **Natural resources/critical inputs.** Discovery of new natural resources or of new ways to recover them (e.g., fracking) can be expected to enhance potential growth, directly via production of those resources and indirectly by reducing the cost of production for other products. Conversely, sustained reduction in the supply of important resources diminishes growth (e.g., the OPEC oil shock in 1973).
- **Financial crises.** The financial system allows the economy to channel resources to their most efficient use. Financial crises arise when market participants lose confidence in others’ ability (or willingness) to meet their obligations and cease to provide funding—first to specific counterparties and then more broadly as potential losses cascade through the system. As discussed in Exhibit 3, a financial crisis may affect both the level of output and the trend growth rate.

Exhibit 3 Trend Growth after a Financial Crisis

An extensive study of growth and debt dynamics in the wake of the 2007–2009 global financial crisis identified three types of crises:

- Type 1: A persistent (permanent, one-time) decline in the level of output, but the subsequent trend rate of growth is unchanged.

(continued)

Exhibit 3 (Continued)

- Type 2: No persistent decline in the level of output, but the subsequent trend rate of growth is reduced.
- Type 3: Both a persistent decline in the level of output and a reduction in the subsequent trend rate of growth.

The Eurozone experienced a sharp, apparently permanent drop in output after the global financial crisis, and subsequent growth was markedly lower than before the crisis, suggesting a Type 3 crisis.

The Eurozone's stagnant growth may be traced to structural problems in conjunction with policy missteps. Structural issues included rigid labor markets, a relatively rapid aging of the population, legal and regulatory barriers, cultural differences among countries, use of a common currency in dissimilar economies, and lack of a unified fiscal policy. In terms of policy response, the European Central Bank was slow to cut rates, was slow to expand its balance sheet, and failed to sustain that expansion. Insolvent banks were allowed to remain operational, thwarting deleveraging of the financial system. In part as the result of a lack of fiscal integration that would have facilitated cross-country transfers, several countries were forced to adopt drastic budget cuts that magnified the impact on their particular economies, the differential impact across countries, and the consequences of structural impediments.

Note: See Luigi Buttiglione, Philip R. Lane, Lucrezia Reichlin, and Vincent Reinhart, "Deleveraging? What Deleveraging?", September 2014, International Center for Monetary and Banking Studies.

It should be clear that any of the shocks listed would likely constitute a "regime change" as discussed earlier.

EXAMPLE 4**Impact of Exogenous Shocks on Trend Growth**

Philippe Leblanc, an analyst focusing on economic forecasting, recently read about a discovery by scientists at a major university that may allow the efficiency of solar panels to double every two to three years, a result similar to Moore's Law with respect to computer chips. In further reading, he found new research at Tsinghua University that may rapidly increase the distance over which electricity can be transmitted.

What implications should Leblanc draw with regard to growth trends if either, or both, of these developments come to fruition? What government policy changes might offset the impact?

Guideline answer:

Either of these developments would be expected to increase trend growth. They would be especially powerful together. Rapid increases in solar panel efficiency would drive down the cost of energy over time, especially in areas with long days and intense sunlight. The closer to the equator, the larger the potential effect. The developments would also make it increasingly possible to bring large-scale power production to remote areas, thereby expanding the range and scale of economically viable businesses in those areas. Extending the range of electrical transmission would allow moving lower-cost energy (regardless of how it is generated) to where it is most efficiently used. A variety of government actions could undermine the pro-growth nature of these developments; for example,

tariffs on solar panels, restrictions on electrical transmission lines, subsidies to support less efficient energy sources, failure to protect intellectual property rights, or prohibition on transfer of technology.

3.2.2 Application of Growth Analysis to Capital Market Expectations

The expected trend rate of economic growth is a key consideration in a variety of contexts. First, it is an important input to discounted cash flow models of expected return. The trend growth rate imposes discipline on forecasts of fundamental metrics such as earnings because these must be kept consistent with aggregate long-run growth at the trend rate. Second, a country with a higher trend rate of growth may offer equity investors a particularly good return if that growth has not already been priced into the market. Third, a higher trend rate of growth in the economy allows actual growth to be faster before accelerating inflation becomes a significant concern. This fact is especially important in projecting the likely path of monetary policy and bond yields. Fourth, theory implies, and empirical evidence confirms, that the average level of real government bond yields is linked to the trend growth rate. Faster trend growth implies higher average real yields.

Most countries have had periods of faster and slower trend growth during their development. Emerging countries often experience rapid growth as they catch up with the leading industrial countries, but the more developed they become, the more likely it is that their growth will slow.

3.2.2.1 A Decomposition of GDP Growth and Its Use in Forecasting The simplest way to analyze an economy's aggregate trend growth is to split it into the following components:

- growth from labor inputs, consisting of
 - growth in potential labor force size and
 - growth in actual labor force participation, plus
- growth from labor productivity, consisting of
 - growth from increasing capital inputs and
 - growth in total factor productivity.

Labor input encompasses both the number of workers and the average number of hours they work. Growth in the potential labor force size is driven by demographics such as the population's age distribution, net migration, and workplace norms such as the length of the work week. All of these factors tend to change slowly, making growth in the potential labor force relatively predictable. Trends in net migration and workplace norms, however, may change abruptly in response to sudden structural changes, such as changes in government policies.

Labor force participation primarily reflects labor versus leisure decisions by workers. All else the same, we should expect labor force participation to decline (or at least grow more slowly) as a country becomes more affluent. On the other hand, rising real wages tend to attract workers back into the labor force. Social norms and government policies also play a large role.

Growth in labor productivity comes from investment in additional capital per worker ("capital deepening") and from increases in **total factor productivity** (TFP), which is often taken to be synonymous with technological improvement.⁸ Government

⁸ Total factor productivity captures a variety of effects, such as the impact of adding not just *more* physical capital (i.e., "capital deepening") but *better* capital, as well as the impact of increasingly skilled labor (i.e., increases in "human capital"). Earlier readings provide a more granular breakdown of the drivers/components of growth.

policy (e.g., regulations) can also influence TFP. In historical analyses, TFP is often measured as a “residual”—that is, output growth that is not accounted for by the other factors.

The trend rate of growth in mature, developed markets is generally fairly stable. As a result, extrapolating past trends in the components outlined in the foregoing can be expected to provide a reasonable initial estimate of the future growth trend. This forecast should then be adjusted to reflect observable information indicating how future patterns are likely to differ from past patterns. This same approach can be applied to less developed markets. It must be recognized, however, that these economies are likely to be undergoing rapid structural changes that may require the analyst to make more significant adjustments relative to past trends.

3.2.2.2 Anchoring Asset Returns to Trend Growth Both theory and empirical evidence indicate that the average level of real (nominal) default-free bond yields is linked to the trend rate of real (nominal) growth.⁹ To put it another way, bond yields will be pulled toward this level over time. Thus, the trend rate of growth provides an important anchor for estimating bond returns over horizons long enough for this reversion to prevail over cyclical and short-term forces. Intertemporal consistency demands that this anchor be factored into forecasts even for shorter horizons.

The trend growth rate also provides an anchor for long-run equity appreciation.¹⁰ We can express the aggregate market value of equity, V^e , as the product of three factors: the level of nominal GDP, the share of profits in the economy, S^k (earnings/GDP), and the P/E ratio (PE).

$$V_t^e = \text{GDP}_t \times S_t^k \times PE_t$$

It is clear that over long periods, capital's share of income cannot continually increase or decrease. The same is true for the P/E multiple applied to earnings. As a result, in the long run, the growth rate of the total value of equity in an economy is linked to the growth rate of GDP. Over finite horizons, the way in which the share of capital and the P/E multiple are expected to change will also affect the forecast of the total value of equity, as well as its corresponding growth rate over that period.

This argument applies to the capital appreciation component of equity returns. It does not supply a way to estimate the other component: the dividend yield. An estimate for the dividend yield (annual dividends/market value) can be obtained by noting that the dividend yield equals the dividend payout ratio (dividends/profit) divided by the profit multiple (market value/profit). The analyst may set any two of these three ratios and infer the third.

EXAMPLE 5

Long-Run Equity Returns and Economic Growth

In January 2000, Alena Bjornsdottir, CFA, was updating her firm's projections for US equity returns. The firm had always used the historical average return with little adjustment. Bjornsdottir was aware that historical averages are subject to large sampling errors and was especially concerned about this fact because of the sequence of very high returns in the late 1990s. She decided to examine whether US equity returns since World War II had been consistent with economic growth. For the period 1946–1999, the continuously compounded (i.e., logarithmic) return was 12.18% per annum, which reflected the following components:

⁹ With regard to nominal yields and growth, it is assumed that inflation is sufficiently well behaved.

¹⁰ See Stewart, Piros, and Heisler (forthcoming 2019) for more thorough development of these arguments.

Real GDP Growth	Inflation	EPS/GDP (Chg)	P/E (Chg)	Dividend Yield
3.14%	4.12%	0.00%	0.95%	3.97%

Questions

- 1 What conclusion was Bjornsdottir likely have drawn from this analysis?
- 2 If she believed that in the long run that the US labor input would grow by 0.9% per annum and labor productivity by 1.5%, that inflation would be 2.1%, that the dividend yield would be 2.25%, and that there would be no further growth in P/E, what is likely to have been her baseline projection for continuously compounded long-term US equity returns?
- 3 In light of her analysis, how might she have adjusted her baseline projection?

Guideline answers

- 1 Bjornsdottir is likely have concluded that the post-war stock return exceeded what would have been consistent with growth of the economy. In particular, the rising P/E added 0.95% of “extra” return per year for 54 years, adding $51.3\% (= 54 \times 0.95\%)$ to the cumulative, continuously compounded return and leaving the market 67% ($\exp[51.3\%] = 1.67$) above “fair value.”
- 2 Her baseline projection is likely to have been $6.75\% = 0.9\% + 1.5\% + 2.1\% + 2.25\%$.
- 3 She is likely to have adjusted her projection downward to some degree to reflect the likelihood that the effect of the P/E would decline toward zero over time. Assuming, for example, that this would occur over 30 years would imply reducing the baseline projection by $1.71\% = (51.3\%/30)$ per year.

Note: The P/E impact was actually eliminated by the end of 2005. Had Bjornsdottir anticipated such a rapid correction, she would have needed to reduce her projection by $10.26\% = 51.3\%/5$ per year to $-3.51\% = 6.75\% - 10.26\%$.

Studies have shown that countries with higher economic growth rates do not reliably generate higher equity market returns.¹¹ A partial explanation is likely to be that the higher growth rate was already reflected in market prices. The sources of growth may be a second factor. Stock market returns ultimately reflect the rate of return on invested capital. If the capital stock is growing rapidly, the rate of return on invested capital may be driven down. Both of these explanations are consistent with the arguments outlined earlier. High growth need not translate one-for-one into higher return unless it can be expected to continue forever. Declining return on investment essentially means that either GDP growth slows or profits decline as a share of GDP, or both. And, of course, valuation multiples do matter.

¹¹ Joachim Klement, “What’s Growth Got to Do With It? Equity Returns and Economic Growth,” *Journal of Investing* Summer 2015 is one such study covering 44 countries.

3.3 Approaches to Economic Forecasting

Whereas the trend growth rate is a long-term average and reflects only the supply side of the economy, most macroeconomic forecasting focuses on short- to intermediate-term fluctuations around the trend—that is, the business cycle. These fluctuations are usually ascribed primarily to shifts in aggregate demand, although shifts in the short-term aggregate supply curve also play a role.

Before discussing the business cycle, we outline the main approaches available for tracking and projecting these movements. There are at least three distinct approaches:

- Econometric models: the most formal and mathematical.
- Indicators: variables that lead, lag, or coincide with turns in the economy.
- Checklists: subjective integration of the answers to relevant questions.

These approaches are not mutually exclusive. Indeed, thorough analysis is likely to incorporate elements of all three.

3.3.1 *Econometric Modeling*

Econometrics is the application of statistical methods to model relationships among economic variables. **Structural models** specify functional relationships among variables based on economic theory. The functional form and parameters of these models are derived from the underlying theory. **Reduced-form models** have a looser connection to theory. As the name suggests, some such models are simply more-compact representations of underlying structural models. At the other end of the spectrum are models that are essentially data driven, with only a heuristic rationale for selection of variables and/or functional forms.

Econometric models vary from small models with a handful of equations to large, complex models with hundreds of equations. They are all used in essentially the same way, however. The estimated system of equations is used to forecast the future values of economic variables, with the forecaster supplying values for the exogenous variables. For example, such a model may require the forecaster to enter exchange rates, interest rates, commodity prices, and/or policy variables. The model then uses the estimated past relationships to forecast the future. It is important to consider that the forecaster's future values for the exogenous variables are themselves subject to estimation error. This fact will increase the variability of potential forecast errors of the endogenous variables beyond what results from errors in the estimated parameter values. The analyst should examine a realistic range of values for the exogenous variables to assess the forecast's sensitivity to these inputs.

Econometric models are widely regarded as very useful for simulating the effects of changes in key variables. The great merit of the econometric approach is that it constrains the forecaster to a certain degree of consistency and also challenges the modeler to reassess prior views based on what the model concludes. It does have important limitations, however. Econometric models require the user to find adequate measures for the real-world activities and relationships to be modeled. These measures may be unavailable. Variables may also be measured with error. Relationships among the variables may change over time because of changes in economic structure and/or because the model may have been based on faulty assumptions as to how the world works. As a result, the econometric model may be mis-specified. In practice, therefore, skillful econometric modelers monitor the model's recent forecasts for signs of systematic errors. Persistent forecast errors should ideally lead to a complete overhaul of the model. In practice, however, a more pragmatic approach is often adopted: Past forecast errors are incorporated into the model as an additional explanatory variable.

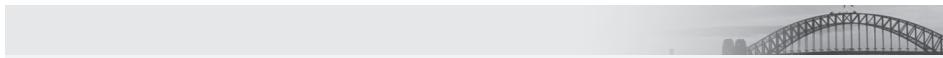
3.3.2 Economic Indicators

Economic indicators are economic statistics published by official agencies and/or private organizations. These indicators contain information on an economy's recent past activity or its current or future position in the business cycle. Lagging economic indicators and coincident indicators reflect recent past and current economic activity, respectively. A **leading economic indicator** (LEI) moves ahead of the business cycle by a fairly consistent time interval. Most analysts focus primarily on leading indicators because they purport to provide information about upcoming changes in economic activity, inflation, interest rates, and security prices.

Leading indicator-based analysis is the simplest forecasting approach to use because it requires following only a limited number of statistics. It also has the advantage of not requiring the analyst to make assumptions about the path of exogenous variables. Analysts use both individual LEIs and composite LEIs, reflecting a collection of economic data releases combined to give an overall reading. The OECD composite LEI for each country or region is based on five to nine variables such as share prices, manufacturing metrics, inflation, interest rates, and monetary data that exhibit cyclical fluctuations similar to GDP, with peaks and troughs occurring six to nine months earlier with reasonable consistency. Individual LEIs can also be combined into a so-called **diffusion index**, which measures how many indicators are pointing up and how many down. For example, if 7 out of 10 are pointing upward, then the odds are that the economy is accelerating.

One of the drawbacks of the (composite) leading indicator methodology is that the entire history may be revised each month. As a result, the most recently published historical indicator series will almost certainly appear to have fit past business cycles (i.e., GDP) better than it actually did in real time. This distortion is known as "look ahead" bias. Correspondingly, the LEI may be less reliable in predicting the current/next cycle than history suggests.

Business cycle indicators have been published for decades. A new methodology for tracking the business cycle, known generically as "nowcasting," emerged in the United States in the wake of the global financial crisis. The best-known of these forecasts, the Federal Reserve Bank of Atlanta's "GDPNow," was first published on 1 May 2014 for the second quarter of that year. The objective is to forecast GDP for the current quarter (which will not be released until after quarter-end) based on data as it is released throughout the quarter. To do this, the Atlanta Fed attempts to use the same methodology and data as will be used by the Bureau of Economic Analysis (BEA) to estimate GDP, replacing data that has not yet been released with forecasts based on the data already observed. As the quarter progresses, more of the actual data will have been observed, and GDPNow should, at least on average, converge to what will be released by the BEA.



BEA releases of estimates

The BEA releases a sequence of three GDP estimates for each quarter. The first, labeled the "advance" estimate, is released four weeks after the end of the quarter and tends to have the greatest market impact. The "preliminary" estimate is released a month later, and the "final" estimate comes at the end of the following quarter. The Atlanta Fed's GDPNow is actually a forecast of the BEA's advance estimate, not of the final GDP release.

It remains to be seen how useful nowcasting will be for investment analysts. It has a couple of clear advantages: It is updated in real time, and it is focused directly on a variable of primary interest (GDP and its components). Nowcasting is not designed to

be predictive of anything beyond the end of the current quarter, however. In addition, it tends to be very volatile until a significant portion of the data for the quarter has been observed, at which point it may have lost some of its usefulness as a guide for investment decisions.

3.3.3 Checklist Approach

Formally or informally, many forecasters consider a whole range of economic data to assess the economy's future position. Checklist assessments are straightforward but time-consuming because they require continually monitoring the widest possible range of data. The data may then be extrapolated into forecasts via objective statistical methods, such as time-series analysis, or via more subjective or judgmental means. An analyst may then assess whether the measures are in an equilibrium state or nearer to an extreme reading.

The subjectivity of the checklist approach is perhaps its main weakness. The checklist's strength is its flexibility. It allows the forecaster to quickly take into account changes in economic structure by changing the variables or the weights assigned to variables within the analysis.

3.3.4 Economic Forecasting Approaches: Summary of Strengths and Weaknesses

Exhibit 4 summarizes the advantages and disadvantages of forecasting using econometric models, leading indicators, and checklists.

Exhibit 4 Economic Forecasting Approaches: Strengths and Weaknesses

Strengths	Weaknesses
Econometric Models Approach <ul style="list-style-type: none"> ■ Models can be quite robust, with many factors included to approximate reality. ■ New data may be collected and consistently used within models to quickly generate output. ■ Delivers quantitative estimates of impact of changes in exogenous variables. ■ Imposes discipline/consistency on analysis. 	<ul style="list-style-type: none"> ■ Complex and time-consuming to formulate. ■ Data inputs not easy to forecast. ■ Relationships not static. Model may be mis-specified. ■ May give false sense of precision. ■ Rarely forecasts turning points well.
Leading Indicator-Based Approach <ul style="list-style-type: none"> ■ Usually intuitive and simple in construction. ■ Focuses primarily on identifying turning points. ■ May be available from third parties. Easy to track. 	<ul style="list-style-type: none"> ■ History subject to frequent revision. <ul style="list-style-type: none"> ● “Current” data not reliable as input for historical analysis. ● Overfitted in-sample. Likely overstates forecast accuracy. ■ Can provide false signals. ■ May provide little more than binary (no/yes) directional guidance.

Exhibit 4 (Continued)

Strengths	Weaknesses
Checklist Approach	
<ul style="list-style-type: none"> ■ Limited complexity. ■ Flexible. <ul style="list-style-type: none"> ● Structural changes easily incorporated. ● Items easily added/dropped. ● Can draw on any information, from any source, as desired. ■ Breadth: Can include virtually any topics, perspectives, theories, and assumptions. 	<ul style="list-style-type: none"> ■ Subjective. Arbitrary. Judgmental. ■ Time-consuming. ■ Manual process limits depth of analysis. No clear mechanism for combining disparate information. ■ Imposes no consistency of analysis across items or at different points in time. May allow use of biased and/or inconsistent views, theories, assumptions.

EXAMPLE 6**Approaches to Forecasting**

Sara Izek and Adam Berke are members of the asset allocation committee at Cycle Point Advisors, which emphasizes the business cycle within its tactical asset allocation process. Berke has developed a time series model of the business cycle that uses a published LEI series as a key input. He presents forecasts based on the model at each asset allocation meeting. Izek is eclectic in her approach, preferring to sample research from a wide variety of sources each month and then focus on whatever perspectives and results seem most interesting. She usually brings a stack of charts she has copied to the asset allocation meeting.

Questions:

- 1 Which of the main forecasting approaches (or combination of approaches) best describe(s) each analyst's own practice?
- 2 What strength(s) are likely to have appealed to each analyst?
- 3 What weaknesses might each analyst be overlooking?

Guideline answers:

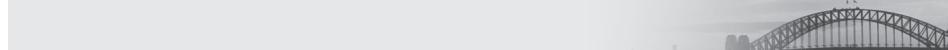
- 1 Berke uses the econometric modeling approach in conjunction with the LEI approach. Izek's practice is essentially a checklist approach.
- 2 Berke is probably attracted to the quantitative output provided by a model, the consistency and discipline it imposes on the process, and the ability to generate explicit forecasts. He may have included the LEI in the model because it is designed to capture cyclical turning points or simply because doing so improves the model's statistical fit of the model.
Izek is probably drawn to the flexibility of the checklist approach with respect to what is included/excluded and how to evaluate the information.
- 3 Berke may be overlooking potential mis-specification of his model, which is apt to make his forecasts systematically inaccurate (i.e., biased). He may also be failing to recognize the likely magnitude of the forecast errors that will be present even if the model is unbiased (i.e., overestimating the precision of the forecasts). By using the historical LEI series as an input to the model, he may be incorporating look-ahead bias into the model.

Izek is likely overlooking the subjective, judgmental, and idiosyncratic nature of her approach. Her practice of basing her “checklist” on what seems most interesting in other analysts’ current research makes her process especially vulnerable to inconsistency and cognitive biases.

3.4 Business Cycle Analysis

The trend rate of economic growth provides a vital anchor for setting very long-run investment expectations, which in turn provide a starting point for developing projections over short- to intermediate-term horizons. Virtually by definition, deviations from trend wash out in the long run, making information about the current economic and market environment of limited value over very long horizons. Over short to intermediate horizons, however, such information can be very important. From a macroeconomic perspective, the most useful such information typically pertains to fluctuations associated with the **business cycle**.

It is useful to think of fluctuations in economic activity as a superposition of many cycles varying in frequency from very short (days) to very long (decades), each with stochastic amplitude. The business cycle is not a specific, well-defined cycle. It is the result of many intermediate frequency cycles that jointly generate most of the variation in aggregate economic activity (i.e., GDP) around the trend. This fact explains why historical business cycles have varied in both duration and intensity—each was a different realization of a range of underlying stochastic cycles. It also helps to explain why it is difficult to project turning points in real time.



Business cycle peaks and troughs

The best-known record of business cycle peaks and troughs is published for the United States by the National Bureau of Economic Research (NBER). According to NBER, the United States has experienced 66 complete business cycles since 1854, averaging 56 months from peak to peak. The longest cycle was 128 months, the shortest only 17 months. Fifty percent of the cycles lasted between 38 and 69 months. On average, the cycle’s contraction phase (peak to trough) lasted 17 months, whereas the expansion phase (trough to peak) lasted 39 months.

At a fundamental level, the business cycle arises in response to the interaction of uncertainty, expectational errors, and rigidities that prevent instantaneous adjustment to unexpected events. It reflects decisions that

- a are made based on imperfect information and/or analysis with the expectation of future benefits,
- b require significant current resources and/or time to implement, and
- c are difficult and/or costly to reverse.

Such decisions are, broadly defined, investment decisions. Much of the uncertainty that sustains the cycle is endogenous to the system. Competitors, suppliers, employers, creditors, customers, and policymakers do not behave as expected. Prices and quantities adjust more or less than expected. Other sources of uncertainty are more exogenous. Technological breakthroughs threaten to disrupt whole industries and/or create new ones. Fracking, gene sequencing, e-commerce, “big data,” digital advertising, cybersecurity, 3-D printing, the internet of things, and driverless cars are among those now playing out. Weather patterns affect agriculture, construction, and

transportation. Natural disasters devastate local economies. Political and geopolitical shifts favor some entities and disadvantage others. And, of course, shocks in one part of the global economy are often transmitted to other parts of the world through trade relations, financial markets, and the prices of goods and services.

Numerous variables can be used to monitor the business cycle. Among them are GDP growth, industrial production (IP), employment/unemployment, purchasing managers indexes, orders for durable goods, the output gap (the difference between GDP estimated as if the economy were on its trend growth path and the actual value of GDP), and the leading indicator indexes discussed earlier.

3.4.1 Phases of The Business Cycle

There are various ways to delineate phases of the business cycle. The most obvious is to divide it into two primary segments (the expansion and the contraction) with two key turning points at which growth changes sign (the peak and the trough). These two periods are fairly easy to identify, at least in retrospect. Subdividing the cycle more finely is more ambiguous, even in retrospect, because it requires identifying more nuanced changes such as acceleration or deceleration of growth without a change in direction. Nonetheless, it is useful to divide the cycle into several phases distinguished through both economic and financial market characteristics. For the purpose of setting expectations for capital markets, we use five phases of the business cycle here: initial recovery, early expansion, late expansion, slowdown, and contraction. The first four occur within the overall expansion.

- 1 Initial recovery.** This period is usually a short phase of a few months beginning at the trough of the cycle in which the economy picks up, business confidence rises, stimulative policies are still in place, the output gap is large, and inflation is typically decelerating. Recovery is often supported by an upturn in spending on housing and consumer durables.

Capital market effects: Short-term rates and government bond yields are low. Bond yields may continue to decline in anticipation of further disinflation but are likely to be bottoming. Stock markets may rise briskly as fears of a longer recession (or even a depression) dissipate. Cyclical assets—and riskier assets, such as small stocks, higher-yield corporate bonds, and emerging market equities and bonds—attract investors and typically perform well.

- 2 Early expansion.** The economy is gaining some momentum, unemployment starts to fall but the output gap remains negative, consumers borrow and spend, and businesses step up production and investment. Profits typically rise rapidly. Demand for housing and consumer durables is strong.

Capital market effects: Short rates are moving up as the central bank starts to withdraw stimulus put in place during the recession. Longer-maturity bond yields are likely to be stable or rising slightly. The yield curve is flattening. Stocks trend upward.

- 3 Late expansion.** The output gap has closed, and the economy is increasingly in danger of overheating. A boom mentality prevails. Unemployment is low, profits are strong, both wages and inflation are rising, and capacity pressures boost investment spending. Debt coverage ratios may deteriorate as balance sheets expand and interest rates rise. The central bank may aim for a “soft landing” while fiscal balances improve.

Capital market effects: Interest rates are typically rising as monetary policy becomes restrictive. Bond yields are usually rising, more slowly than short rates, so the yield curve continues to flatten. Private sector borrowing puts pressure

on credit markets. Stock markets often rise but may be volatile as nervous investors endeavor to detect signs of looming deceleration. Cyclical assets may underperform while inflation hedges such as commodities outperform.

- 4 Slowdown.** The economy is slowing and approaching the eventual peak, usually in response to rising interest rates, fewer viable investment projects, and accumulated debt. It is especially vulnerable to a shock at this juncture. Business confidence wavers. Inflation often continues to rise as firms raise prices in an attempt to stay ahead of rising costs imposed by other firms doing the same.

Capital market effects: Short-term interest rates are high, perhaps still rising, but likely to peak. Government bond yields top out at the first clear sign of a slowing economy and may then decline sharply. The yield curve may invert, especially if the central bank continues to exert upward pressure on short rates. Credit spreads, especially for weaker credits generally widen. The stock market may fall, with interest-sensitive stocks such as utilities and “quality” stocks with stable earnings performing best.

- 5 Contraction.** Recessions typically last 12 to 18 months. Investment spending, broadly defined, typically leads the contraction. Firms cut production sharply. Once the recession is confirmed, the central bank eases monetary policy. Profits drop sharply. Tightening credit magnifies downward pressure on the economy. Recessions are often punctuated by major bankruptcies, incidents of uncovered fraud, exposure of aggressive accounting practices, or a financial crisis. Unemployment can rise quickly, impairing household financial positions.

Capital market effects: Short-term interest rates drop during this phase, as do bond yields. The yield curve steepens substantially. The stock market declines in the earlier stages of the contraction but usually starts to rise in the later stages, well before the recovery emerges. Credit spreads typically widen and remain elevated until signs of a trough emerge and it becomes apparent that firms will be able to roll over near-term debt maturities.

3.4.2 Market Expectations and the Business Cycle

This description of a typical business cycle may suggest that forming capital market expectations for short and intermediate horizons should be relatively straightforward. If an investor can identify the current phase of the cycle and correctly predict when the next phase will begin, is it not easy to make money? Unfortunately, it is not that simple.

First, the phases of the business cycle vary in length and amplitude. Recessions can be steep, and downturns (such as in the 1930s and in 2007–2009) can be frightening. On the other hand, recessions also can be short lived, with only a small decline in output and only a modest rise in unemployment. Sometimes, the weakest phase of the cycle does not even involve a recession but merely a period of slower economic growth or a “growth recession.” Similarly, expansions vary in length and intensity.

Second, it is not always easy to distinguish between cyclical forces and secular forces acting on the economy and the markets. The prolonged recovery following the 2007–2009 global financial crisis is a prime example. Interest rates and inflation went far lower and remained extraordinarily low far longer than virtually anyone would have predicted based on a purely cyclical view.

Third, although the connection between the real economy and capital market returns is strong, it is subject to substantial uncertainty. Capital market prices reflect a composite of investors’ expectations and attitudes toward risk with respect to all future horizons. How, when, and by how much the markets respond to the business cycle are as uncertain as the cycle itself—perhaps more so.

What does all of this variation and uncertainty imply for setting capital market projections? First, as with virtually any investment information, business cycle analysis generates a noisy signal with respect to prospective opportunities. Second, the signal is likely to be most reliable (a higher “signal-to-noise” ratio), and hence most valuable, over horizons within the range of likely expansion and contraction phases—perhaps one to three years. Returns over substantially shorter horizons are likely to be driven primarily by market reactions to more transitory developments, undermining the cycle’s predictive value. On the other hand, as the forecast horizon extends beyond this range, it becomes increasingly likely that one or more turning points will occur within the horizon, implying returns that increasingly reflect averaging over the cycle.

EXAMPLE 7**Cycles, Horizons, and Expectations**

Lee Kim uses a statistical model that divides the business cycle into two “regimes”: expansion and contraction. The expected (continuously compounded) return on equities is +2% per month during expansions and -2% per month during contractions. Consistent with NBER’s historical record (see earlier sidebar), the probabilities of transitioning between regimes imply that expansions last 39 months on average, whereas contractions average 20 months. Correspondingly, over the long run, the economy expands roughly two-thirds of the time and contracts one-third of the time. Hence, the long-term expected equity return is $0.67\% = [(2\% \times 2/3) + (-2\% \times 1/3)]$ per month, or 8% per year. Kim’s model indicates that the economy recently transitioned into contraction. For the upcoming asset allocation committee meeting, he will prepare equity return forecasts for horizons of 3 months, 1 year, 5 years, and 10 years.

Explain how you would expect the choice of time horizon to affect Kim’s projections.

Guideline answer

The longer the horizon, the more likely that one or more transitions will occur between contraction and expansion; more generally, the more likely it is that the horizon spans more than one business cycle phase or even more than one full cycle. As a result, the longer the horizon, the more Kim’s forecast should reflect averaging over periods of expansion and contraction and the closer it will be to the “information-less” average of 8% per year.

Over the next three months, it is highly likely that the economy will remain in contraction, so Kim’s forecast for that period should be very close to -2% per month [cumulatively -6%]. Because contractions last 20 months on average in the model, Kim’s forecast for a one-year horizon should reflect only a modestly higher probability of having transitioned to expansion at some point within the period. So, his forecast might be -18% (an average of -1.5% per month) instead of -24% (-2% per month). Over a five-year horizon, it is very likely that the economy will have spent time in both contraction and expansion. As a result, Kim’s forecast will put significant weight on each phase. Because the economy starts in contraction (i.e., the starting point is not random), the weight on that phase will probably be somewhat higher than its long-term frequency of 1/3, say 0.40. This assumption implies a forecast of 4.8% per year [= $12 \times [(0.6 \times 2\%) + (0.4 \times -2\%)]$]. Over a 10-year horizon, the frequency of expansion and contraction months is likely to be very close to the 2-to-1 long-run ratio. So, Kim’s forecast should be very close to 8% per year.

3.4.3 Inflation and Deflation: Trends and Relation to the Business Cycle

Until the early 20th century, the money supply was largely dictated by the supply of specie—gold and/or silver used in coins and to back bank deposits. Periods of both inflation and deflation were common. Today, currencies are backed by the credibility of governments and central banks rather than specie, and people expect the prices of goods and services to trend upward. Persistent deflation is rare. Expectation of an upward trend in prices reflects recognition of an asymmetry in a central bank's so-called "reaction function." It is generally accepted that a central bank's policy tools are more effective in slowing economic activity than in accelerating sluggish activity. Hence, central banks may tend to be more aggressive in combating downward pressure on demand than in reining in strong demand. In addition, it is widely believed that outright deflation damages the economy because it undermines:

- debt-financed investments. Servicing and repayment of nominally fixed debt becomes more onerous as nominal income flows and the nominal value of real assets both decline; and
- the power of central banks. In a deflationary environment, interest rates fall to levels close to (or even below) zero. When interest rates are already very low, the central bank has less leeway to stimulate the economy by lowering interest rates.

In contrast, moderate inflation is generally considered to impose only modest costs on the economy. Both the differential effectiveness of policy and the differential costs of inflation versus deflation suggest that central banks will, implicitly or explicitly, target positive inflation, and investors set their expectations accordingly. The result is that asset prices in general and bond yields in particular generally build in compensation for a positive average inflation rate.

Inflation is procyclical, accelerating in the later stages of the business cycle when the output gap has closed and decelerating when, during a recession or the early years afterward, there is a large output gap, which puts downward pressure on wages and prices. If the central bank's target is credible, the average rate of inflation over the cycle should be near the target.

Because the cyclical pattern of inflation is well known, inflation expectations will also be procyclical. It is important, however, to differentiate inflation expectations by horizon. Very long-term inflation expectations should be virtually unaffected by cyclical fluctuations provided investors maintain confidence in the central bank's target. Short horizon expectations will tend to have about the same amplitude as actual inflation. Inflation, and therefore inflation expectations, over intermediate horizons will be a blend of the different phases of the current and subsequent cycles. Hence, the amplitude of expectations will decline with horizon—again, provided investors do not lose confidence in the central bank's target.

The pattern just described implies a "horizon structure" of inflation expectations that is countercyclical—upward sloping at the trough of the business cycle and inverted at the peak. Because inflation expectations are an important component of bond yields, this countercyclical pattern is one of the reasons that the yield curve's slope is countercyclical.¹²

¹² As will be discussed later, compensation for taking duration risk (the "term premium") is procyclical. As a result, an inverted "horizon structure" of expected inflation does not necessarily imply an inverted yield curve.

To assess the effect of inflation on asset classes, we must consider both the cash flows and the discount rates. We consider “cash,” nominal bonds, stocks, and real estate.

- *Cash:* In this context, cash is taken to mean short-term interest-bearing instruments, not currency or zero-interest deposits. As long as short-term interest rates adjust with expected inflation, cash is essentially a zero-duration, inflation-protected asset that earns a floating real rate. Inflation above or below expectation contributes to temporary fluctuations in the realized real return. Because central banks aim to stabilize actual and expected inflation, they tend to make the real rate on cash procyclical around a long-term level consistent with their target inflation rate. Hence, cash is relatively attractive (unattractive) in a rising (declining) rate environment. Deflation may make cash particularly attractive if a zero-lower-bound is binding on the nominal interest rate. Otherwise deflation is simply a component of the required short-term real rate.
- *Bonds:* Because the cash flows are fixed in nominal terms, the effect of inflation is transmitted solely through the discount rates (i.e., the yield curve). Rising (falling) inflation induces capital losses (gains) as the expected inflation component of yields rises (falls). If inflation remains within the expected cyclical range, shorter-term yields rise/fall more than longer yields but have less price impact as a result of shorter duration. If, however, inflation moves out of the expected range, longer-term yields may rise/fall more sharply as investors reassess the likelihood of a change in the long-run average level of inflation. Persistent deflation benefits the highest-quality bonds because it increases the purchasing power of the cash flows, but it is likely to impair the creditworthiness of lower-quality debt.
- *Stocks:* As long as inflation stays within the expected cyclical range, there should be little effect on stocks because both expected future cash flows (earnings and dividends) and associated discount rates rise/fall in line with the horizon structure of inflation expectations. Signs that inflation is moving out of the expected range, however, indicate a potential threat. Unexpectedly high and/or rapidly rising inflation could mean that the central bank needs to act to slow the economy, whereas very low and/or falling inflation (possibly deflation) threatens a recession and a decline in asset prices. Within the stock market, higher inflation benefits firms that are able to pass along rising costs, whereas deflation is especially detrimental for asset-intensive, commodity-producing, and/or highly leveraged firms.
- *Real estate:* Short- to intermediate-term nominal cash flows are generally dictated by existing leases, with the speed of adjustment depending on the type of real estate asset held. As long as inflation remains within the expected range, renewal of leases will likely generate rental income rising with expected inflation, accompanied by stable asset values. Higher-than-expected inflation is likely to coincide with high demand for real estate, expectations that rental income will rise even faster than general inflation, and rising property values. The impact may be quite idiosyncratic, however, depending on the length of leases, the existing supply of similar properties, and the likelihood of new supply hitting the market when leases come up for renewal. On the other hand, unexpectedly low inflation (or deflation) will put downward pressure on expected rental income and property values, especially for less-than-prime properties, which may have to cut rents sharply to avoid rising vacancies.

EXAMPLE 8**Inflation**

Kesia Jabari believes the quantitative easing undertaken by major central banks in the wake of the global financial crisis is finally about to induce a surge in inflation. She believes that without extraordinary policy actions from the central banks, the inflation rate will ultimately rise to the upper end of central banks' tolerance ranges at the peak of the current business cycle.

Assuming Jabari is correct, discuss the likely implications for floating-rate instruments ("cash"), bonds, stocks, and real estate if:

- a the market shares Jabari's view, or
- b once inflation begins to rise, the market doubts that the central banks will be able to contain it.

Guideline answer

- a If the market agrees with Jabari, then the relationship of inflation and the asset classes to the business cycle should be fairly normal. Short-term rates and bond yields will rise with inflation expectations. The yield curve should flatten because long-term inflation expectations should remain well anchored. Floating-rate instruments (cash) will be relatively attractive, and intermediate maturities ("the belly of the curve") will be the most vulnerable. In general, the rise in inflation should not have much independent impact on stocks or real estate because both cash flows and discount rates will be expected to rise. Firms with pricing power and real estate with relatively short lease-renewal cycles are set to perform best.
- b If the market doubts that central banks can contain inflation within previously perceived tolerances, then long-run inflation expectations will rise and the yield curve may steepen rather than flatten, at least initially. Floating-rate instruments will still be relatively attractive, but now it is the longest maturities that will be the most vulnerable. Stocks are likely to suffer because the market expects central banks to be aggressive in fighting inflation. Real estate with long-term leases and little long-term, fixed-rate debt will suffer. Real estate with substantial long-term, fixed-rate debt should do relatively well, especially high-quality properties with little new supply nearby, which are likely to avoid significant vacancies even in a recession.

In the interest of completeness, we should note a caveat before leaving the topic of inflation. The preceding discussion implicitly assumes that the short-run aggregate supply curve is upward sloping and that the business cycle is primarily driven by fluctuations in aggregate demand. Together, these assumptions imply that inflation is pro-cyclical. Although globalization may have reduced the sensitivity of domestic prices to domestic output, it seems unlikely that domestic output/growth no longer matters. Thus, the aggregate supply curve may be *flatter* but is unlikely to be *flat*. With regard to what drives the cycle, if aggregate supply shocks predominate, then inflation will tend to be *countercyclical*, reflecting alternating periods of "stagflation" and disinflationary boom. The 1970s oil crisis is a prime example. This pattern is more likely to be the exception rather than the rule, however.

3.5 Analysis of Monetary and Fiscal Policy

Actual and anticipated actions by monetary and fiscal authorities affect the decisions and actions of all other participants in the economy and the markets. As a result, it is somewhat difficult to isolate their role(s) from our broader discussion. Indeed, the foregoing sections have made numerous references to these policies. Nonetheless it is worthwhile to focus directly on these policies from the perspective of setting capital market expectations.

Monetary policy is often used as a mechanism for intervention in the business cycle. Indeed, this use is inherent in the mandates of most central banks to maintain price stability and/or growth consistent with the economy's potential. Each central bank interprets its mandate somewhat differently, sets its own operational objectives and guidelines, and selects its own mix of the tools (e.g., policy rates and liquidity provision) at its disposal. The common theme is that central banks virtually always aim to moderate the cyclical behavior of growth and inflation, in both directions. Thus, monetary policy aims to be countercyclical. The impact of monetary policy, however, is famously subject to "long and variable lags," as well as substantial uncertainty. As a result, a central bank's ability to fine-tune the economy is limited, and there is always risk that policy measures will exacerbate rather than moderate the business cycle. This risk is greatest at the top of the cycle, when the central bank may overestimate the economy's momentum and/or underestimate the effects of restrictive policies. In such situations, monetary policy may trigger a contraction that it cannot immediately counteract. In contrast, expansionary monetary policy rarely, if ever, suffices to turn a contraction into a strong recovery. This asymmetry is captured in a classic analogy: Expansionary policy is like "pushing" on a string, whereas restrictive policy is like "pulling" on a string.

Fiscal policy (government spending and taxation) can also be used to counteract cyclical fluctuations in the economy. Aside from extreme situations, however—such as the Great Depression of the 1930s and recovery from the 2007–2009 global financial crisis—fiscal policy typically addresses objectives other than regulating short-term growth, for at least two main reasons. First, in all but the most authoritarian regimes, the fiscal decision-making process is too lengthy to make timely adjustments to aggregate spending and taxation aimed at short-term objectives. Second, frequent changes of a meaningful magnitude would be disruptive to the ongoing process of providing and funding government services.

Notwithstanding these considerations, fiscal policy often does play a role in mitigating cyclical fluctuations. Progressive tax regimes imply that the effective tax rate on the private sector is pro-cyclical—rising as the economy expands and falling as the economy contracts. Similarly, means-based transfer payments vary inversely with the economy, helping to mitigate fluctuations in disposable income for the most vulnerable households. The effect of these so-called automatic stabilizers should not be overlooked in setting expectations for the economy and the markets.

From the perspective of an investment analyst focused on establishing expectations for broad asset classes, having a handle on monetary policy is mission-critical with respect to cyclical patterns. Under normal conditions, fiscal adjustments are important but likely to be secondary considerations. The reverse is likely with respect to assessing the long run. Of course, if a major change in fiscal stance is contemplated or has been implemented, the impact warrants significant attention with respect to all horizons. The major overhaul of the US tax code at the end of 2017 is a good example of these points. It almost certainly provided a short-term stimulus, especially with respect to capital expenditures. But it was not a short-term policy adjustment. It was the most significant change to the tax code in decades, a major structural change that may affect the path of both the economy and the markets for many years.

3.5.1 Monetary Policy

Central banks can, and do, carry out their mandates somewhat differently. In general, they seek to mitigate extremes in inflation and/or growth via countercyclical policy measures. As a generic illustration of how this might work, we briefly review the **Taylor rule**. In the current context, it can be viewed as a tool for assessing a central bank's stance and a guide to predicting how that stance is likely to evolve.

In essence, the Taylor rule links a central bank's target short-term nominal interest rate to the expected growth rate of the economy and inflation, relative to trend growth and the central bank's inflation target.

$$i^* = r_{\text{neutral}} + \pi_e + 0.5(\hat{Y}_e - \hat{Y}_{\text{trend}}) + 0.5(\pi_e - \pi_{\text{target}})$$

Where

i^* = target nominal policy rate

r_{neutral} = real policy rate that would be targeted if growth is expected to be at trend and inflation on target

$\pi_e, \pi_{\text{target}}$ = respectively, the expected and target inflation rates

$\hat{Y}_e, \hat{Y}_{\text{trend}}$ = respectively, the expected and trend real GDP growth rates

The rule can be re-expressed in terms of the real, inflation-adjusted target rate by moving the expected inflation rate to the left-hand side of the equation.

$$i^* - \pi_e = r_{\text{neutral}} + 0.5(\hat{Y}_e - \hat{Y}_{\text{trend}}) + 0.5(\pi_e - \pi_{\text{target}})$$

From this rearrangement, we see that the real, inflation-adjusted policy rate deviates from neutral by one-half the amount by which growth and inflation deviate from their respective targets. As an example, suppose the neutral real policy rate is 2.25%, the target inflation rate is 2%, and trend growth is estimated to be 2.5%. If growth is expected to be 3.5% and inflation is expected to be 3%, the Taylor rule would call for a 6.25% nominal policy rate:

$$2.25\% + 3\% + 0.5(3.5\% - 2.5\%) + 0.5(3.0\% - 2.0\%) = 6.25\%$$

With expected inflation at 3%, this calculation corresponds to a 3.25% real policy rate.

Even if a central bank were to set its policy rate according to the Taylor rule, there could still be substantial judgment left in the process. None of the inputs to the rule are objectively observable. To make the rule operational, policymakers and their staffs have to specify how the requisite expectations will be generated, and by whom. Whose estimate of trend growth is to be used? What is the appropriate neutral real policy rate? Over what horizon(s) do the expectations apply? Models could be developed to answer all these questions, but there would be judgments to be made in doing so. The upshot for the investment analyst is that monetary policy cannot be reduced to a simple equation. The Taylor rule, or some customized variant, provides a good framework for analyzing the thrust and likely evolution of monetary policy, but the analyst must pay careful attention to situational signals from the central bank. This is why, for example, the investment community literally scrutinizes every word in the Federal Reserve's post-meeting statements and speeches by officials, looking for any hint of a change in the Fed's own interpretation of the environment.

EXAMPLE 9**Policies and the Business Cycle**

Albert Grant, CFA, is an institutional portfolio strategist at Camford Advisors. After a period of trend growth, inflation at the central bank's target, and neutral monetary policy, the economy has been hit by a substantial deflationary shock.

Questions

- 1 How are monetary and fiscal policies likely to respond to the shock?

Camford's economics department estimates that growth is now 1% below trend and inflation is 2% below the central bank's target. Camford's chief investment officer (CIO) has asked Grant to put together a projection of the likely path of policy rates for the next five years.

- 2 If Grant believes the central bank will respond in accordance with the Taylor Rule, what other information will he need in order to project the path of policy rates?
- 3 What pattern should Grant expect for growth, inflation, and market interest rates if the central bank does *not* respond to the shock?
- 4 Assuming the central bank does respond and that its reaction function is well approximated by the Taylor Rule, how will this alter Grant's expectations regarding the paths of growth, inflation, and short-term rates over the next five years?

Guideline answers

- 1 A countercyclical response can be expected from both monetary and fiscal policy. Assuming the central bank uses a policy rate target as its primary tool, it will cut that rate. On the fiscal side, there may be no explicit expansionary policy action (tax cut or spending increase), but automatic stabilizers built into tax and transfer programs can be expected to cushion the shock's impact on private sector disposable incomes.
- 2 Grant will need to know what values the central bank uses for the neutral real rate, trend growth rate, and inflation target. He will also need to know how the central bank forms its expectations of growth and inflation. Finally, he will need to know how growth and inflation are likely to evolve, including how they will be affected by the path of policy rates.
- 3 The deflationary shock is very likely to induce a contractionary phase of the business cycle, putting additional downward pressure on growth and inflation. Short-term market interest rates will be dragged downward by weak demand and inflation. Risky asset prices are likely to fall sharply. A deep and/or protracted recession may be required before conditions conducive to recovery are in place. Grant should therefore expect a deep "U-shaped" path for growth, inflation, and short-term rates.
- 4 If the central bank responds as expected, it will push short-term rates down farther and faster than they would otherwise fall in an effort to mitigate the downward momentum of growth and inflation. If the central bank correctly calibrates its policy, growth and inflation should decline less, bottom out sooner, and recover more quickly toward trend growth and the target inflation level, respectively, than in the absence of a policy response. Whereas the central bank is virtually certain to drive short rates down farther and faster, it may be inclined to let the market dictate the

pace at which rates eventually rise. That is, it may simply “accommodate” the need for higher rates rather than risk unduly restraining the recovery once it is established.

3.5.2 What Happens When Interest Rates Are Zero or Negative?

Prior to the 2007–2009 global financial crisis, it was generally accepted that central banks could not successfully implement negative interest rate policies. Belief in a “zero lower bound” on policy rates assumed that individuals would choose to hold currency (coins and notes) if faced with earning a negative interest rate on short-term instruments, including deposits. The move toward holding currency would drain deposits and reserves from the banking system, causing bank balance sheets to shrink. The resulting credit contraction would put upward pressure on interest rates, thwarting the central bank’s attempt to maintain negative rates. The contraction of credit would likely also put additional downward pressure on economic growth, thereby reinforcing the need for stimulative policies.

This line of reasoning raised questions about the effectiveness of traditional monetary policy when the economy is so weak that economic growth fails to respond to (nominal) interest rates approaching zero. Following the global financial crisis, central banks faced with this situation pursued less conventional measures.

One important measure was quantitative easing (QE), in which central banks committed to large-scale, ongoing purchases of high-quality domestic fixed-income securities. These purchases were funded by creating an equally large quantity of bank reserves in the form of central bank deposits. As a result of QE, central bank balance sheets and bank reserves grew significantly and sovereign bond yields fell. QE was pursued by (among others) the US Federal Reserve, the European Central Bank, the Bank of Japan, and the Bank of England.

Conventional reasoning suggests that QE should have resulted in the desired growth in nominal spending. In theory, banks could use the increased reserves to extend loans, and low interest rates would stimulate businesses and households to borrow. The borrowing was expected to fund capital expenditure by businesses as well as current consumption and purchases of durables (e.g., houses and cars) by households, thereby stimulating the economy. With interest rates low, investors were expected to bid up the prices of stocks and real estate. Although asset prices did increase and businesses that could issue bonds borrowed heavily, proceeds were more often used to fund dividends and stock buybacks rather than capital expenditures. At the same time, household spending ability was significantly curtailed by the legacy of the global financial crisis.

Whether or not QE was effective remains subject to debate. To achieve desired levels of economic growth, central banks tried the previously unthinkable: targeting negative interest rates. The central banks of Denmark, Sweden, Japan, Switzerland, and the euro area were among those that adopted negative policy rates. Contrary to the notion of a “zero lower bound,” negative policy rates proved to be sustainable.

The move into currency did not occur as expected because the scale and speed of transactions inherent in modern economies cannot be supported using physical cash as the primary method of exchange.¹³ Trillions of dollars change hands daily to facilitate trade in goods, services, and financial instruments, and these transactions cannot be

¹³ It should also be noted that banks were reluctant to directly impose negative rates on their retail and commercial deposit customers. In general, rates on these accounts remained non-negative. Thus, the aggregate incentive to move into cash was mitigated somewhat. Various fees (e.g., for overdraft protection) and conditions imposed on the accounts (e.g., compensating balance requirements), however, may still have resulted in a net cost for deposit customers.

accomplished using physical cash. Bank deposits and bank reserves held at the central bank, rather than as vault cash, have an implicit yield or convenience value that cash does not. As long as this value exceeds the explicit cost of holding those deposits—in the form of a negative interest rate—there is no incentive to convert deposits into cash. In such circumstances, negative policy rates may be achievable and sustainable.

In theory, using negative nominal rates to stimulate an economy should work similarly to using low but still positive rates. Businesses and consumers are encouraged to hold fewer deposits for transaction purposes; investors are encouraged to seek higher expected returns on other assets; consumers are encouraged to save less and/or borrow more against future income; businesses are encouraged to invest in profitable projects; and banks are encouraged to use their reserves in support of larger loan books. All of this is expected to stimulate economic growth.

For consumers, investors, businesses, and banks to behave as described, however, each must believe they will be adequately rewarded for taking the inherent risks. In a negative interest rate environment, these entities are likely to have greater levels of uncertainty as to whether they will be adequately compensated for risks taken, and therefore they may not act as desired by monetary policy makers. As a result, the effectiveness of expansionary monetary policy is more tenuous at low and negative interest rate levels than at higher interest rate levels.

3.5.3 Implications of Negative Interest Rates for Capital Market Expectations

Long-run capital market expectations typically take the level of the “risk-free rate” as a baseline to which various risk premiums are added to arrive at long-run expected returns for risky assets such as long-term bonds and equities. The implicit assumption is that the risk-free rate is at its long-term equilibrium level. When short-term rates are negative, the long-run equilibrium short-term rate can be used as the baseline rate in these models instead of the observed negative rate. This rate can be estimated using the neutral policy rate (r_{neutral}) in the Taylor rule (or more generally in the central bank’s presumed reaction function), adjusted for a modest spread between policy rates and default-free rates available to investors.

In forming capital market expectations for shorter time horizons, analysts and investors must consider the expected path of interest rates. Paths should be considered that, on average, converge to the long-run equilibrium rate estimate. With negative policy rates in place, this approach means a negative starting point. In theory, many possible scenarios, each appropriately weighted by its likelihood, should be considered. In practice, it may suffice to consider only a few scenarios. Because shorter horizons provide less opportunity for the impact of events to average out, the shorter the forecast horizon, the more important it is to consider deviations from the most likely path.

Negative policy rates are expected to produce asset class returns similar to those occurring in the contraction and early recovery phases of a “more normal” business/policy cycle. Although such historical periods may provide a reasonable starting point in formulating appropriate scenarios, it is important to note that negative rate periods may indicate severe distress in the economy and thus involve greater uncertainty regarding the timing and strength of recovery.

Key considerations when forming capital market expectations in a negative interest rate environment include the following:

- Historical data are less likely to be reliable.
 - Useful data may exist on only a few historical business cycles, which may not include instances of negative rates. In addition, fundamental structural/institutional changes in markets and the economy may have occurred since this data was generated.
 - Quantitative models, especially statistical models, tend to break down in situations that differ from those on which they were estimated/calibrated.

- Forecasting must account for differences between the current environment and historical averages. Historical averages, which average out differences across phases of the cycle, will be even less reliable than usual.
- The effects of other monetary policy measures occurring simultaneously (e.g., quantitative easing) may distort market relationships such as the shape of the yield curve or the performance of specific sectors.

Incorporating uncertain dynamics, including negative interest rates, into capital market expectations over finite horizons is much more difficult than projecting long-term average levels. The challenge arises from the fact that asset prices depend not only on investor expectations regarding longer term “equilibrium” levels but also on the path taken to get there.

3.5.4 The Monetary and Fiscal Policy Mix

Fiscal policy is inherently political. Central banks ultimately derive their powers from governments, but most strive to be, or at least appear to be, independent of the political process in order to maintain credibility. As a result, to the extent that monetary and fiscal policy are coordinated, it is usually the case that the central bank takes the expected fiscal stance as given in formulating its own policy and disdains guidance from politicians regarding its policy.

The mix of monetary and fiscal policies has its most apparent impact on the level of interest rates and the shape of the yield curve. We first consider the effect of persistently loose or tight policies on the average level of rates. All else the same, loose fiscal policies (large deficits) increase the level of *real* interest rates because the domestic private sector must be induced to save more/investing less and/or additional capital must be attracted from abroad. Conversely, tight fiscal policies reduce real rates. Persistently loose monetary policy generally results in higher actual and expected inflation. Attempts by the central bank to hold down nominal rates will prove self-defeating, ultimately resulting in higher rather than lower nominal interest rates.¹⁴ Conversely, persistently tight monetary policy ultimately reduces actual and expected inflation resulting in lower, rather than higher, nominal rates. Exhibit 5 summarizes the impact of persistent policy mixes on the level of real and nominal rates. In each case, the impact on real rates and on expected inflation is clear. Two cases involve a mix of loose and tight policy. In these cases, the combined impact could be higher or lower nominal rates. Nominal rates are labelled as “mid” level for these cases.

¹⁴ This was one of the crucial insights presented in Friedman (1968).

Exhibit 5 Effect of Persistent Policy Mix on the Average Level of Rates

		Fiscal Policy	
		Loose	Tight
Monetary Policy	Loose	High Real Rates + High Expected Inflation =	Low Real Rates + High Expected Inflation =
	Tight	High Nominal Rates	Mid Nominal Rates
	Loose	High Real Rates + Low Expected Inflation =	Low Real Rates + Low Expected Inflation =
	Tight	Mid Nominal Rates	Low Nominal Rates

The second impact of policy is on the slope of the yield curve. The slope of the term structure of (default-free) interest rates depends primarily on (1) the expected future path of short-term rates and (2) a risk premium required to compensate for the greater price volatility inherent in longer-maturity bonds. The maturity premium explains why the term structure is normally upward sloping. Changes in the curve's slope—flattening and steepening—are primarily driven by the evolution of short rate expectations, which are mainly driven by the business cycle and policies. This dynamic was described in an earlier discussion on business cycles. Exhibit 6 summarizes the main points regarding the evolution of rates, policy, and the yield curve.

Exhibit 6 Rates, Policy, and the Yield Curve over the Business Cycle

Cycle Phase	Monetary Policy & Automatic Stabilizers	Money Market Rates	Bond Yields and the Yield Curve
Initial Recovery	Stimulative stance. Transitioning to tightening mode.	Low/bottoming. Increases expected over progressively shorter horizons.	Long rates bottoming. Shortest yields begin to rise first. Curve is steep.
Early expansion	Withdrawing stimulus	Moving up. Pace may be expected to accelerate.	Yields rising. Possibly stable at longest maturities. Front section of yield curve steepening, back half likely flattening.
Late expansion	Becoming restrictive	Above average and rising. Expectations tempered by eventual peak/decline.	Rising. Pace slows. Curve flattening from longest maturities inward.
Slowdown	Tight. Tax revenues may surge as accumulated capital gains are realized.	Approaching/reaching peak.	Peak. May then decline sharply. Curve flat to inverted.
Contraction	Progressively more stimulative. Aiming to counteract downward momentum.	Declining.	Declining. Curve steepening. Likely steepest on cusp of Initial Recovery phase.

There is a third factor related to monetary and fiscal policy that may, or may not, be significant with respect to the shape of the yield curve and the effectiveness of policy: the relative supply of (government) bonds at various maturities. Does it matter what maturities the government issues in order to fund deficits? Does it matter what maturities the central bank chooses to buy/sell in its open market operations or its quantitative easing? There is no clear answer. The issue became important, however, in the wake of the global financial crisis for at least two reasons.

First, although it is now apparent that there is no clear lower bound on nominal interest rates, the effectiveness of conventional interest rate policies at very low rate levels remains in question. In particular, the central bank's ability to influence long-term rates may be even more tenuous than usual. Second, governments have run, and continue to run, large deficits while quantitative easing by major central banks has caused them to accumulate massive holdings of government debt (and other securities), which they may ultimately need or want to sell. If relative supply of debt along the yield curve really matters, then how governments fund their deficits in the future and how the central banks manage the maturity of their holdings could have significant implications for the yield curve and the broader financial markets.

It is difficult to draw firm conclusions with respect to maturity management. The existing evidence in conjunction with broader observation of markets, however, suggests the following: Sufficiently large purchases/sales at different maturities are likely to have a meaningful effect on the curve while they are occurring, but the effect is unlikely to be sustained for long once the buy/sell operation ends. To put it another way, a sufficiently large *flow* of supply may have a noticeable impact on relative yields, but discrete changes in the quantity of each maturity outstanding are much less likely to have a lasting impact. Government bonds are very liquid, and investors can and do move up and down the yield curve to exploit even very small yield differentials. Having said that, an important caveat pertaining to very long maturities is appropriate. Pension funds and other entities with very long-dated liabilities need correspondingly very long-maturity assets. Severely limiting the available supply of those assets would undoubtedly drive down their yield. Low yields at the very long end of the UK yield curve have been attributed to this effect at various times.

As a final comment on the interaction of monetary and fiscal policy, we acknowledge the potential for politicization of the central bank. If the level of government debt is high relative to the economy (GDP), and especially if it is also rising because of large fiscal deficits, there is a risk that the central bank may be coerced into inflating away the real value of the debt with very accommodative monetary policy. The risk that this dynamic *may* subsequently occur is almost certain to steepen the yield curve. If it *does* occur, such an event is likely to lead to an inflationary spiral, as higher inflation leads to higher nominal rates, which lead to faster accumulation of debt, which call forth even more accommodative monetary policy, and so on.

3.5.5 The Shape of the Yield Curve and the Business Cycle

The shape of the yield curve is frequently cited as a predictor of economic growth and as an indicator of where the economy is in the business cycle. Both casual observation and formal econometric analysis support its usefulness (an extensive bibliography is available at www.newyorkfed.org). The underlying rationale was summarized earlier in Exhibit 6. In simplest terms, the curve tends to be steep at the bottom of the cycle, flatten during the expansion until it is very flat or even inverted at the peak, and re-steeper during the subsequent contraction. Because expectations with respect to the path of short-term rates are the primary determinant of the curve's shape, the shape of the curve contains information about how market participants perceive the state and likely evolution of the economy as well as the impact they expect policymakers to have on that path. Thus, the empirical link between the shape of the yield curve and subsequent growth passes the test set out earlier for a good model—there is a solid

rationale for believing it should be predictive. One must, of course, be aware that very few macroeconomic variables are truly exogenous and very few endogenous variables are completely unaffected by the past. “A” (shape of the yield curve) may predict “B” (growth next period), but it may also be the case that “B” predicts “A” in the period after that. The point is that the analyst should be aware of the fact that both the shape of the yield curve and economic growth (i.e., the business cycle) are endogenous within the economy. This is not to suggest throwing out a useful relationship but merely a reminder to interpret results with care.

EXAMPLE 10**The Business Cycle and the Yield Curve**

Camford’s quantitative analysis team helped Albert Grant incorporate the central bank’s reaction function into a reduced-form model of growth and inflation. With this model, he will be able to project the path of short-term rates in the wake of the deflationary shock described in Example 9. Camford’s CIO has now asked him to extend the analysis to project the path of bond yields as well.

Questions

- 1 What will Grant need in order to project the path of bond yields?
- 2 Even before he can undertake the formal analysis, a large client asks Grant to explain the likely implications for the yield curve. What can he say?

Guideline answers

- 1 Grant will need a model linking bond yields to the policy rate. In essence, he needs a model of the yield curve.
- 2 Following the deflationary shock, the economy is very likely to enter into the contraction phase of the business cycle. The central bank will be cutting the policy rate, perhaps sharply. Long-term yields could drop even faster initially as the market anticipates that policy, but then the curve will steepen as the central bank cuts rates because long-maturity yields will incorporate the expectation of short-term rates rising again once the economy gains sufficient traction. The curve will likely reach its steepest point near the trough of the policy cycle and then gradually flatten as the economy gains strength and the central bank begins to tighten policy.

3.6 International Interactions

In general, the dependence of any particular country on international interactions is a function of its relative size and its degree of specialization. Large countries with diverse economies, such as the so-called G–7 (the United States, United Kingdom, Germany, France, Italy, Japan, and Canada), tend to be less influenced by developments elsewhere than smaller economies, such as Chile, whose output depends significantly on a few commodities like copper. Nonetheless, increasing globalization of trade, capital flows, and direct investment in recent decades has increased the importance of international interactions for nearly all countries.

3.6.1 Macroeconomic Linkages

Macroeconomic linkages between countries are expressed through their respective current and capital accounts. The current account reflects net exports of goods and services, net investment income flows, and unilateral transfers. The capital account, which for the purposes of this discussion also includes what is known as the financial account, reflects net investment flows for Foreign Direct Investment (FDI)—purchase and sale of productive assets across borders—and Portfolio Investment (PI) flows involving transactions in financial assets. By construction, if a country has a surplus on current account, it must have a matching deficit on capital account, or vice versa. Anything that affects one account must induce an equal and opposite change in the other account.

A nation's current and capital accounts are linked to the broader economy by the fact that net exports, virtually always the most significant component of the current account, contributes directly to aggregate demand for the nation's output. National income accounting also implies the following important relationship among net exports ($X - M$), saving (S), investment (I), and the government surplus ($T - G$):

$$(X - M) = (S - I) + (T - G)$$

Net exports always equal net private saving (the excess of domestic private saving over investment spending) plus the government surplus. Anything that changes net exports must also change net private saving, the government surplus, or both. Conversely, changes in either of these will be transmitted to the rest of the world through the current account. Of course, because the current account and capital accounts are mirror images, we can reverse all the signs in the foregoing equation and make corresponding statements about the capital account. A surplus on capital account is how a nation funds an excess of investment and government spending over domestic saving plus taxes.

There are four primary mechanisms by which the current and capital accounts are kept in balance: changes in income (GDP), relative prices, interest rates and asset prices, and exchange rates. Strictly speaking, all of these tools can play a role in both the real economy (the current account and FDI) and the financial markets, and they are determined simultaneously. However, markets do not all move at the same pace. In particular, investment markets adjust much more quickly than the real economy. In the short run, interest rates, exchange rates, and financial asset prices must adjust to keep the capital account in balance with the more slowly evolving current account. Meanwhile, the current account, in conjunction with real output and the relative prices of goods and services, tends to reflect secular trends and the pace of the business cycle.

EXAMPLE 11

International Macroeconomic Linkages

A large, diversified economy recently instituted a substantial tax cut, primarily aimed at reducing business taxes. Some provisions of the new law were designed to stem the tide of domestic firms moving production facilities abroad and encourage an increase in corporate investment in the domestic economy. There was no reduction in government spending. Prior to the tax cut, the country had both a current account deficit and a government deficit.

Questions:

- 1 What impact is this tax cut likely to have on
 - a the country's current account balance?
 - b the country's capital account balance?

- c growth in other countries?
 - d the current and capital accounts of other countries?
- 2 What adjustments is the tax cut likely to induce in the financial markets?

Guideline answers

- 1 a The deficit on current account will almost certainly increase. The government deficit will increase which, all else the same, will result in a one-for-one increase in the current account deficit. If the tax cut works as intended, domestic investment will increase, reducing net private saving and further increasing the current account deficit. Private saving will increase as a result of rising income (GDP), which will diminish the impact on the current account somewhat. Unless saving increases by the full amount of the tax cut plus the increase in investment spending, however, the net effect will be an increase in the current account deficit. In principle, this increase could be thwarted by movements in the financial markets that make it impossible to fund it, but this is unlikely.
- b Because the current account deficit will increase, the country's capital account surplus must increase by the same amount. In effect, the tax cut will be funded primarily by borrowing from abroad and/or selling assets to non-domestic investors. Part of the adjustment is likely to come from a reduction in FDI by domestic firms (i.e., purchases of productive assets abroad) provided the new tax provisions work as intended.
- c Growth in other countries is likely to increase as the tax cut stimulates demand for their exports and that increase in turn generates additional demand within their domestic economies.
- d In the aggregate, other countries must already be running current account surpluses and capital account deficits matching the balances of the country that has cut taxes. Their aggregate current account surplus and capital account deficit will increase by the same amount as the increase in current account deficit and capital account surplus of the tax-cutting country.
- 2 The country must attract additional capital flows from abroad. This endeavor is likely to be facilitated, at least in part, by the expectation of rising after-tax profits resulting from the business taxes. Equity values should therefore rise. The adjustment may also require interest rates and bond yields to rise relative to the rest of the world. The impact on the exchange rate is less clear. Because the current account and the capital account represent exactly offsetting flows, there is no *a priori* change in demand for the currency. The net impact will be determined by what investors *expect* to happen. (See the following section for a discussion of exchange rate linkages.)

3.6.2 Interest Rate/Exchange Rate Linkages

One of the linkages of greatest concern to investors involves interest rates and exchange rates. The two are inextricably linked. This fact is perhaps most evident in the proposition that a country cannot simultaneously

- allow unrestricted capital flows;

- maintain a fixed exchange rate; and
- pursue an independent monetary policy.

The essence of this proposition is that if the central bank attempts to push interest rates down (up), capital will flow out (in), putting downward (upward) pressure on the exchange rate, forcing the bank to buy (sell) its own currency, and thereby reversing the expansionary (contractionary) policy. Carrying this argument to its logical conclusion suggests that, with perfect capital mobility and a fixed exchange rate, “the” interest rate must be the same in countries whose currencies are pegged to each other.

Can we extend this proposition to encompass the whole (default-free) yield curve? Yes, but in doing so, we have to be somewhat more precise. Under what conditions would two markets share a yield curve? First, there must be unrestricted capital mobility between the markets ensuring that risk-adjusted expected returns will be equalized. The second condition is more difficult: The exchange rate between the currencies must be credibly fixed *forever*.¹⁵ That is, investors must believe there is no risk that the currencies will exchange at a different rate in the future. Otherwise, yield differentials will emerge, giving rise to differential risk and return expectations in the two markets and allowing each market to trade on its own fundamentals. Thus, it is the lack of credibly fixed exchange rates that allows (default-free) yield curves, and hence bond returns, to be less than perfectly correlated across markets.

If a currency is linked to another without full credibility, then bond yields in the weaker currency are nearly always higher. This has been true even in the eurozone where, technically, separate currencies no longer exist—Greece, Italy, and Spain have always traded at meaningful, but varying, spreads over Germany and France. As long as there is no imminent risk of a devaluation, spreads at the very shortest maturities should be comparatively narrow. As demonstrated by the Greek exit (“Grexit”) crisis, however, the situation changes sharply when the market perceives an imminent threat of devaluation (or a withdrawal from the common currency). Spreads then widen throughout the curve, but especially at the shortest maturities, and the curve will almost certainly invert. Why? Because in the event of a devaluation, yields in the devaluating currency will decline sharply (as the currency-risk premium collapses), generating much larger capital gains on longer-term bonds and thereby mitigating more of the currency loss.

When the exchange rate is allowed to float, the link between interest rates and exchange rates is primarily expectational. To equalize risk-adjusted expected returns across markets, interest rates must generally be higher (lower) in a currency that is expected to depreciate (appreciate). Ironically, this dynamic can lead to seemingly perverse situations in which the exchange rate “overshoots” in one direction to generate the expectation of movement in the opposite direction. The expectational linkage among exchange rates, interest rates, and asset prices is covered in detail at a later stage.

Capital mobility alone is clearly insufficient to eliminate differences in *nominal* interest rates and bond yields across countries. To a greater or lesser extent, each market responds to its own fundamentals, including policies. But what about *real* yields? We need to look at this question from two perspectives: the financial markets and the real economy.

An investor cares about the real return that she expects to earn *in her own currency*. In terms of a non-domestic asset, what matters is the *nominal* return and the change in the exchange rate. Even if non-domestic interest rates remain unchanged, the real return earned by the investor will not equal the non-domestic real interest rate unless purchasing power parity (PPP) holds over the investor’s horizon. The empirical evidence overwhelmingly indicates that PPP does not hold over relevant

¹⁵ These conditions are necessary and sufficient for permanent convergence. See Chapter 10 of Stewart, Piros, and Heisler (forthcoming 2019) for a full exposition.

investment horizons. Hence, we cannot rely on the simplistic notion that real interest rate differentials represent exploitable opportunities and should be eliminated by portfolio investment flows.

The preceding point is somewhat subtle and should not be construed to mean that real interest rate differentials are irrelevant for cross-market investment decisions. On the contrary, they can, but do not always, point to the likelihood of favorable *nominal* yield and exchange rate movements. The investor needs to assess non-domestic real rates from that perspective.

Ultimately, real interest rates must be consistent with the real saving and investment decisions that drive economic growth and the productivity of capital. As discussed earlier, saving and investment decisions are linked across countries through their current accounts. “Excess” saving in one country funds “excess” investment in another. In essence, there is a global market in which capital flows to where it is expected to be most productive. Although real rates around the world need not be equal, they are linked through the requirement that global savings must always equal global investment. Hence, they will tend to move together. As an example, the widespread low level of real interest rates that persisted in the aftermath of the global financial crisis was widely attributed to a very high level of global saving—primarily in Asia—and an unusually low level of capital investment in many developed markets, notably the United States.

SUMMARY

This is the first of two readings on how investment professionals should address the setting of capital market expectations. The reading began with a general framework for developing capital market expectations followed by a review of various challenges and pitfalls that analysts may encounter in the forecasting process. The remainder of the reading focused on the use of macroeconomic analysis in setting expectations. The following are the main points covered in the reading:

- Capital market expectations are essential inputs for strategic as well as tactical asset allocation.
- The ultimate objective is a set of projections with which to make informed investment decisions, specifically asset allocation decisions.
- Undue emphasis should not be placed on the accuracy of projections for individual asset classes. Internal consistency across asset classes (cross-sectional consistency) and over various time horizons (intertemporal consistency) are far more important objectives.
- The process of capital market expectations setting involves the following steps:
 - 1 Specify the set of expectations that are needed, including the time horizon(s) to which they apply.
 - 2 Research the historical record.
 - 3 Specify the method(s) and/or model(s) that will be used and their information requirements.
 - 4 Determine the best sources for information needs.
 - 5 Interpret the current investment environment using the selected data and methods, applying experience and judgment.
 - 6 Provide the set of expectations and document the conclusions.
 - 7 Monitor outcomes, compare to forecasts, and provide feedback.
- Among the challenges in setting capital market expectations are:

- *limitations of economic data* including lack of timeliness as well as changing definitions and calculations;
 - *data measurement errors and biases* including transcription errors, survivorship bias, and appraisal (smoothed) data;
 - *limitations of historical estimates* including lack of precision, nonstationarity, asynchronous observations, and distributional considerations such as fat tails and skewness;
 - *ex post risk as a biased risk measure* such as when historical returns reflect expectations of a low-probability catastrophe that did not occur or capture a low-probability event that did happen to occur;
 - *bias in methods* including data-mining and time-period biases;
 - *failure to account for conditioning information;*
 - *misinterpretation of correlations;*
 - *psychological biases* including anchoring, status quo, confirmation, overconfidence, prudence, and availability biases.
 - *model uncertainty.*
- Losing sight of the connection between investment outcomes and the economy is a fundamental, and potentially costly, mistake in setting capital market expectations.
 - Some growth trend changes are driven by slowly evolving and easily observable factors that are easy to forecast. Trend changes arising from exogenous shocks are impossible to forecast and difficult to identify, assess, and quantify until the change is well established.
 - Among the most important sources of shocks are policy changes, new products and technologies, geopolitics, natural disasters, natural resources/critical inputs, and financial crises.
 - An economy's aggregate trend growth rate reflects growth in labor inputs and growth in labor productivity. Extrapolating past trends in these components can provide a reasonable initial estimate of the future growth trend, which can be adjusted based on observable information. Less developed economies may require more significant adjustments because they are likely to be undergoing more rapid structural changes.
 - The average level of real (nominal) default-free bond yields is linked to the trend rate of real (nominal) growth. The trend rate of growth provides an important anchor for estimating bond returns over horizons long enough for this reversion to prevail over cyclical and short-term forces.
 - The trend growth rate provides an anchor for long-run equity appreciation. In the very long run, the aggregate value of equity must grow at a rate very close to the rate of GDP growth.
 - There are three main approaches to economic forecasting:
 - *Econometric models:* structural and reduced-form statistical models of key variables generate quantitative estimates, impose discipline on forecasts, may be robust enough to approximate reality, and can readily forecast the impact of exogenous variables or shocks. However, they tend to be complex, time-consuming to formulate, and potentially mis-specified, and they rarely forecast turning points well.

- *Indicators:* variables that lead, lag, or coincide with turns in the economy. This approach is the simplest, requiring only a limited number of published statistics. It can generate false signals, however, and is vulnerable to revisions that may overfit past data at the expense of the reliability of out-of-sample forecasts.
- *Checklist(s):* subjective integration of information deemed relevant by the analyst. This approach is the most flexible but also the most subjective. It readily adapts to a changing environment, but ongoing collection and assessment of information make it time-consuming and also limit the depth and consistency of the analysis.
- The business cycle is the result of many intermediate frequency cycles that jointly generate most of the variation in aggregate economic activity. This explains why historical business cycles have varied in both duration and intensity and why it is difficult to project turning points in real time.
- The business cycle reflects decisions that (a) are made based on imperfect information and/or analysis with the expectation of future benefits, (b) require significant current resources and/or time to implement, and (c) are difficult and/or costly to reverse. Such decisions are, broadly defined, investment decisions.
- A typical business cycle has a number of phases. We split the cycle into five phases with the following capital market implications:
 - **Initial Recovery.** Short-term interest rates and bond yields are low. Bond yields are likely to bottom. Stock markets may rise strongly. Cyclical/riskier assets such as small stocks, high-yield bonds, and emerging market securities perform well.
 - **Early Expansion.** Short rates are moving up. Longer-maturity bond yields are stable or rising slightly. Stocks are trending up.
 - **Late Expansion.** Interest rates rise, and the yield curve flattens. Stock markets often rise but may be volatile. Cyclical assets may underperform while inflation hedges outperform.
 - **Slowdown.** Short-term interest rates are at or nearing a peak. Government bond yields peak and may then decline sharply. The yield curve may invert. Credit spreads widen, especially for weaker credits. Stocks may fall. Interest-sensitive stocks and “quality” stocks with stable earnings perform best.
 - **Contraction.** Interest rates and bond yields drop. The yield curve steepens. The stock market drops initially but usually starts to rise well before the recovery emerges. Credit spreads widen and remain elevated until clear signs of a cycle trough emerge.
- At least three factors complicate translation of business cycle information into capital market expectations and profitable investment decisions. First, the phases of the cycle vary in length and amplitude. Second, it is not always easy to distinguish between cyclical forces and secular forces acting on the economy and the markets. Third, how, when, and by how much the markets respond to the business cycle is as uncertain as the cycle itself—perhaps more so.
- Business cycle information is likely to be most reliable/valuable in setting capital market expectations over horizons within the range of likely expansion and contraction phases. Transitory developments cloud shorter-term forecasts, whereas significantly longer horizons likely cover portions of multiple cycle phases. Information about the current cyclical state of the economy has no predictive value over very long horizons.

- Monetary policy is often used as a mechanism for intervention in the business cycle. This mechanism is inherent in the mandates of most central banks to maintain price stability and/or growth consistent with potential.
- Monetary policy aims to be countercyclical, but the ability to fine-tune the economy is limited and policy measures may exacerbate rather than moderate the business cycle. This risk is greatest at the top of the cycle when the central bank may overestimate the economy's momentum and/or underestimate the potency of restrictive policies.
- Fiscal policy—government spending and taxation—can be used to counteract cyclical fluctuations in the economy. Aside from extreme situations, however, fiscal policy typically addresses objectives other than regulating short-term growth. So-called automatic stabilizers do play an important role in mitigating cyclical fluctuations.
- The Taylor Rule is a useful tool for assessing a central bank's stance and for predicting how that stance is likely to evolve.
- The expectation that central banks could not implement negative policy rates proved to be unfounded in the aftermath of the 2007–2009 global financial crisis. Because major central banks combined negative policy rates with other extraordinary measures (notably quantitative easing), however, the effectiveness of the negative rate policy is unclear. The effectiveness of quantitative easing is also unclear.
- Negative interest rates, and the environment that gives rises to them, make the task of setting capital market expectations even more complex. Among the issues that arise are the following:
 - It is difficult to justify negative rates as a “risk-free rate” to which risk premiums can be added to establish long-term “equilibrium” asset class returns.
 - Historical data and quantitative models are even less likely to be reliable.
 - Market relationships (e.g., the yield curve) are likely to be distorted by other concurrent policy measures.
- The mix of monetary and fiscal policies has its most apparent effect on the average level of interest rates and inflation. Persistently loose (tight) fiscal policy increases (reduces) the average level of real interest rates. Persistently loose (tight) monetary policy increases (reduces) the average levels of actual and expected inflation. The impact on nominal rates is ambiguous if one policy is persistently tight and the other persistently loose.
- Changes in the slope of the yield curve are driven primarily by the evolution of short rate expectations, which are driven mainly by the business cycle and policies. The slope of the curve may also be affected by debt management.
- The slope of the yield curve is useful as a predictor of economic growth and as an indicator of where the economy is in the business cycle.
- Macroeconomic linkages between countries are expressed through their respective current and capital accounts.
- There are four primary mechanisms by which the current and capital accounts are kept in balance: changes in income (GDP), relative prices, interest rates and asset prices, and exchange rates.
- In the short run, interest rates, exchange rates, and financial asset prices must adjust to keep the capital account in balance with the more slowly evolving current account. The current account, in conjunction with real output and the relative prices of goods and services, tends to reflect secular trends and the pace of the business cycle.

- Interest rates and currency exchange rates are inextricably linked. This relationship is evident in the fact that a country cannot simultaneously allow unfettered capital flows, maintain a fixed exchange rate, and pursue an independent monetary policy.
- Two countries will share a default-free yield curve if (and only if) there is perfect capital mobility and the exchange rate is credibly fixed *forever*. It is the lack of credibly fixed exchange rates that allows (default-free) yield curves, and hence bond returns, to be less than perfectly correlated across markets.
- With floating exchange rates, the link between interest rates and exchange rates is primarily expectational. To equalize risk-adjusted expected returns across markets, interest rates must be higher (lower) in a currency that is expected to depreciate (appreciate). This dynamic can lead to the exchange rate “overshooting” in one direction to generate the expectation of movement in the opposite direction.
- An investor cares about the real return that he or she expects to earn *in his or her own currency*. In terms of a foreign asset, what matters is the *nominal* return and the change in the exchange rate.
- Although real interest rates around the world need not be equal, they are linked through the requirement that global savings must always equal global investment. Hence, they will tend to move together.

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PRACTICE PROBLEMS

The following information relates to Questions 1–8

Neshie Wakuluk is an investment strategist who develops capital market expectations for an investment firm that invests across asset classes and global markets. Wakuluk started her career when the global markets were experiencing significant volatility and poor returns; as a result, she is now careful to base her conclusions on objective evidence and analytical procedures to mitigate any potential biases.

Wakuluk's approach to economic forecasting utilizes a structural model in conjunction with a diffusion index to determine the current phase of a country's business cycle. This approach has produced successful predictions in the past, thus Wakuluk has high confidence in the predictions. Wakuluk also determines whether any adjustments need to be made to her initial estimates of the respective aggregate economic growth trends based on historical rates of growth for Countries X and Y (both developed markets) and Country Z (a developing market). Exhibit 1 summarizes Wakuluk's predictions:

Exhibit 1 Prediction for Current Phase of the Business Cycle

Country X	Country Y	Country Z
Initial Recovery	Contraction	Late Upswing

Wakuluk assumes short-term interest rates adjust with expected inflation and are procyclical. Wakuluk reviews the historical short-term interest rate trends for each country, which further confirms her predictions shown in Exhibit 1.

Wakuluk decides to focus on Country Y to determine the path of nominal interest rates, the potential economic response of Country Y's economy to this path, and the timing for when Country Y's economy may move into the next business cycle. Wakuluk makes the following observations:

- Observation 1 Monetary policy has been persistently loose for Country Y, while fiscal policies have been persistently tight.
- Observation 2 Country Y is expected to significantly increase transfer payments and introduce a more progressive tax regime.
- Observation 3 The current yield curve for Country Y suggests that the business cycle is in the slowdown phase, with bond yields starting to reflect contractionary conditions.

- 1 Wakuluk *most likely* seeks to mitigate which of the following biases in developing capital market forecasts?
 - A Availability
 - B Time period
 - C Survivorship

- 2 Wakuluk's approach to economic forecasting:
 - A is flexible and limited in complexity.
 - B can give a false sense of precision and provide false signals.
 - C imposes no consistency of analysis across items or at different points in time.
 - 3 Wakuluk is *most likely* to make significant adjustments to her estimate of the future growth trend for which of the following countries?
 - A Country Y only
 - B Country Z only
 - C Countries Y and Z
 - 4 Based on Exhibit 1 and Wakuluk's assumptions about short-term rates and expected inflation, short-term rates in Country X are *most likely* to be:
 - A low and bottoming.
 - B approaching a peak.
 - C above average and rising.
 - 5 Based on Exhibit 1, what capital market effect is Country Z *most likely* to experience in the short-term?
 - A Cyclical assets attract investors.
 - B Monetary policy becomes restrictive.
 - C The yield curve steepens substantially.
 - 6 Based on Observation 1, fiscal and monetary policies in Country Y will *most likely* lead to:
 - A low nominal rates.
 - B high nominal rates.
 - C either high or low nominal rates.
 - 7 Based on Observation 2, what impact will the policy changes have on the trend rate of growth for Country Y?
 - A Negative
 - B Neutral
 - C Positive
 - 8 Based on Observation 3, Wakuluk *most likely* expects Country Y's yield curve in the near term to:
 - A invert.
 - B flatten.
 - C steepen.
-

SOLUTIONS

- 1 A is correct. Wakuluk started her career when the global markets were experiencing significant volatility and poor returns. She is careful to base her conclusions on objective evidence and analytical procedures to mitigate potential biases, which suggests she is seeking to mitigate an availability bias. Availability bias is the tendency to be overly influenced by events that have left a strong impression and/or for which it is easy to recall an example.
- 2 B is correct. Wakuluk's approach to economic forecasting utilizes both a structural model (e.g., an econometric model approach) and a diffusion index (e.g., a leading indicator-based approach). However, the two approaches have weaknesses: An econometric model approach may give a false sense of precision, and a leading indicator-based approach can provide false signals. Two strengths of the checklist approach are its flexibility and limited complexity, although one weakness is that it imposes no consistency of analysis across items or at different points in time.
- 3 B is correct. Country Z is a developing market. Less-developed markets are likely to be undergoing more rapid structural changes, which may require the analyst to make more significant adjustments relative to past trends.
- 4 A is correct. Country X is predicted to be in the initial recovery phase of the business cycle, which suggests short-term (money market) rates are low or bottoming. Inflation is procyclical. It accelerates in the later stages of the business cycle when the output gap has closed, and it decelerates when a large output gap puts downward pressure on wages and prices, which often happens during a recession or the early years afterward. As long as short-term interest rates adjust with expected inflation, cash is essentially a zero-duration, inflation-protected asset that earns a floating real rate, which is typically procyclical. Wakuluk assumes short-term interest rates adjust with expected inflation and are procyclical. Thus, short-term rates are most likely to be low and bottoming if Country X is in the initial recovery phase of the business cycle.
- 5 B is correct. Wakuluk's model predicts that Country Z's business cycle is currently in the late upswing phase. In the late upswing phase, interest rates are typically rising as monetary policy becomes more restrictive. Cyclical assets may underperform, whereas the yield curve is expected to continue to flatten.
- 6 C is correct. Monetary policy has been persistently loose for Country Y, while fiscal policies have been persistently tight. With this combination of persistently loose and tight policies, the impact could lead to higher or lower nominal rates (typically labeled as mid-nominal rates).
- 7 C is correct. Country Y is expected to significantly increase transfer payments and introduce a more progressive tax regime. Both of these changes are pro-growth government policies and should have a positive impact on the trend rate of growth for a business cycle that is in slowdown or contraction. Transfer payments help mitigate fluctuations in disposable income for the most vulnerable households, while progressive tax regimes imply that the effective tax rate on the private sector is pro-cyclical (i.e., rising as the economy expands and falling as the economy contracts).
- 8 C is correct. The current yield curve for Country Y suggests that the business cycle is in the slowdown phase (curve is flat to inverted), with bond yields starting to reflect contractionary conditions (i.e., bond yields are declining). The curve will most likely steepen near term, consistent with the transition to the contractionary phase of the business cycle, and be the steepest on the cusp of the initial recovery phase.

READING

11

Capital Market Expectations, Part 2: Forecasting Asset Class Returns

by Christopher D. Piros, PhD, CFA

Christopher D. Piros, PhD, CFA (USA).

LEARNING OUTCOMES

Mastery	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. discuss approaches to setting expectations for fixed-income returns;
<input type="checkbox"/>	b. discuss risks faced by investors in emerging market fixed-income securities and the country risk analysis techniques used to evaluate emerging market economies;
<input type="checkbox"/>	c. discuss approaches to setting expectations for equity investment market returns;
<input type="checkbox"/>	d. discuss risks faced by investors in emerging market equity securities;
<input type="checkbox"/>	e. explain how economic and competitive factors can affect expectations for real estate investment markets and sector returns;
<input type="checkbox"/>	f. discuss major approaches to forecasting exchange rates;
<input type="checkbox"/>	g. discuss methods of forecasting volatility;
<input type="checkbox"/>	h. recommend and justify changes in the component weights of a global investment portfolio based on trends and expected changes in macroeconomic factors.

INTRODUCTION

1

This is the second of two readings focusing on capital market expectations. A central theme of both readings is that a disciplined approach to setting expectations will be rewarded. After outlining a framework for developing expectations and reviewing potential pitfalls, the first reading focused on the use of macroeconomic analysis in

Parts of this reading have been adapted from a former Capital Market Expectations reading authored by John P. Calverley, Alan M. Meder, CPA, CFA, Brian D. Singer, CFA, and Renato Staub, PhD.

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setting expectations. This reading builds on that foundation and examines setting expectations for specific asset classes—fixed income, equities, real estate, and currencies. Estimation of variance–covariance matrices is covered as well.

The reading begins with an overview of the techniques frequently used to develop capital market expectations. The discussion of specific asset classes begins with fixed income in Section 3, followed by equities, real estate, and currencies in Sections 4–6. Estimation of variance–covariance structures is addressed in Section 7. Section 8 illustrates the use of macroeconomic analysis to develop and justify adjustments to a global portfolio.

2

OVERVIEW OF TOOLS AND APPROACHES

This section provides a brief overview of the main concepts, approaches, and tools used in professional forecasting of capital market returns. Whereas subsequent sections focus on specific asset classes, the emphasis here is on the commonality of techniques.

2.1 The Nature of the Problem

Few investment practitioners are likely to question the notion that investment opportunities change in systematic, but imperfectly predictable, ways over time. Yet the ramifications of that fact are often not explicitly recognized. Forecasting returns is not simply a matter of estimating constant, but unknown, parameters—for example, expected returns, variances, and correlations. Time horizons matter. The previous reading highlighted two aspects of this issue: the need to ensure intertemporal consistency and the relative usefulness of specific information (e.g., the business cycle) over short, intermediate, and long horizons. The choice among forecasting techniques is effectively a choice of the information on which forecasts will be based (in statistical terms, the information on which the forecast is “conditioned”) and how that information will be incorporated into the forecasts. The fact that opportunities change over time should, at least in principle, affect strategic investment decisions and how positions respond to changing forecasts.¹

Although investment opportunities are not constant, virtually all forecasting techniques rely on notions of central tendency, toward which opportunities tend to revert over time. This fact means that although asset prices, risk premiums, volatilities, valuation ratios, and other metrics may exhibit momentum, persistence, and clustering in the short run, over sufficiently long horizons, they tend to converge to levels consistent with economic and financial fundamentals.

What are we trying to forecast? In principle, we are interested in the whole probability distribution of future returns. In practice, however, forecasting expected return is by far the most important consideration, both because it is the dominant driver of most investment decisions and because it is generally more difficult to forecast within practical tolerances than such risk metrics as volatility. Hence, the primary focus here is on expected return. In terms of risk metrics, we limit our attention to variances and covariances.

¹ For example, in general, it is not optimal to choose a portfolio on the mean–variance-efficient frontier based on forecasts for the coming period. In addition, the distinction between “strategic” and “tactical” asset allocation is less clear cut since, in general, the optimal allocation evolves with the investor’s remaining investment horizon. See Piros (2015) for a non-technical exposition of these issues.

2.2 Approaches to Forecasting

At a very high level, there are essentially three approaches to forecasting: (1) formal tools, (2) surveys, and (3) judgment. Formal tools are established research methods amenable to precise definition and independent replication of results. Surveys involve asking a group of experts for their opinions. Judgment can be described as a qualitative synthesis of information derived from various sources and filtered through the lens of experience.

Surveys are probably most useful as a way to gauge consensus views, which can serve as inputs into formal tools and the analyst's own judgment. Judgment is always important. There is ample scope for applying judgment—in particular, economic and psychological insight—to improve forecasts and numbers, including those produced by elaborate quantitative models. In using survey results and applying their own judgment, analysts must be wary of the psychological traps discussed in the Capital Market Expectations Part 1 reading. Beyond these brief observations, however, there is not much new to be said about surveys and judgment.

The formal forecasting tools most commonly used in forecasting capital market returns fall into three broad categories: statistical methods, discounted cash flow models, and risk premium models. The distinctions among these methods will become clear as they are discussed and applied throughout the reading.

2.2.1 Statistical Methods

All the formal tools involve data and statistical analysis to some degree. Methods that are primarily, if not exclusively, statistical impose relatively little structure on the data. As a result, the forecasts inherit the statistical properties of the data with limited, if any, regard for economic or financial reasoning. Three types of statistical methods will be covered in this reading. The first approach is to use well-known sample statistics, such as sample means, variances, and correlations, to describe the distribution of future returns. This is undoubtedly the clearest example of simply taking the data at face value. Unfortunately, sampling error makes some of these statistics—in particular, the sample mean—very imprecise. The second approach, **shrinkage estimation**, involves taking a weighted average of two estimates of the same parameter—one based on historical sample data and the other based on some other source or information, such as the analyst's “prior” knowledge. This “two-estimates-are-better-than-one” approach has the desirable property of reducing forecast errors relative to simple sample statistics. The third method, **time-series estimation**, involves forecasting a variable on the basis of lagged values of the variable being forecast and often lagged values of other selected variables. These models have the benefit of explicitly incorporating dynamics into the forecasting process. However, since they are reduced-form models, they may summarize the historical data well without providing much insight into the underlying drivers of the forecasts.

2.2.2 Discounted Cash Flow

Discounted cash flow (DCF) models express the idea that an asset's value is the present value of its expected cash flows. They are a basic method for establishing the intrinsic value of an asset on the basis of fundamentals and its fair required rate of return. Conversely, they are used to estimate the required rate of return implied by the asset's current price.

2.2.3 Risk Premium Models

The risk premium approach expresses the expected return on a risky asset as the sum of the risk-free rate of interest and one or more risk premiums that compensate investors for the asset's exposure to sources of *priced risk* (risk for which investors demand compensation). There are three main methods for modeling risk premiums:

(1) an equilibrium model, such as the CAPM, (2) a factor model, and (3) building blocks. Each of these methods was discussed in earlier readings. Equilibrium models and factor models both impose a structure on how returns are assumed to be generated. Hence, they can be used to generate estimates of (1) expected returns and (2) variances and covariances.

3

FORECASTING FIXED-INCOME RETURNS

There are three main ways to approach forecasting fixed-income returns. The first is discounted cash flow. This method is really the only one that is precise enough to use in support of trades involving individual fixed-income securities. This type of “micro” analysis will not be discussed in detail here since it is covered extensively elsewhere in CFA Program curriculum readings that focus on fixed income. DCF concepts are also useful in forecasting the more aggregated performance needed to support asset allocation decisions. The second approach is the risk premium approach, which is often applied to fixed income, in part because fixed-income premiums are among the building blocks used to estimate expected returns on riskier asset classes, such as equities. The third approach is to include fixed-income asset classes in an equilibrium model. Doing so has the advantage of imposing consistency across asset classes and is especially useful as a first step in applying the Black–Litterman framework, which will be discussed in a later reading.

3.1 Applying DCF to Fixed Income

Fixed income is really all about discounted cash flow. This stems from the facts that almost all fixed-income securities have finite maturities and that the (promised) cash flows are known, governed by explicit rules, or can be modeled with a reasonably high degree of accuracy (e.g., mortgage-backed security prepayments). Using modern arbitrage-free models, we can value virtually any fixed-income instrument. The most straightforward and, undoubtedly, most precise way to forecast fixed-income returns is to explicitly value the securities on the basis of the assumed evolution of the critical inputs to the valuation model—for example, the spot yield curve, the term structure of volatilities, and prepayment speeds. A whole distribution of returns can be generated by doing this for a variety of scenarios. As noted previously, this is essentially the only option if we need the “micro” precision of accounting for rolling down the yield curve, changes in the shape of the yield curve, changes in rate volatilities, or changes in the sensitivity of contingent cash flows. But for many purposes—for example, asset allocation—we usually do not need such granularity.

Yield to maturity (YTM)—the single discount rate that equates the present value of a bond’s cash flows to its market price—is by far the most commonly quoted metric of valuation and, implicitly, of expected return for bonds. For bond portfolios, the YTM is usually calculated as if it were simply an average of the individual bonds’ YTM, which is not exactly accurate but is a reasonable approximation.² Forecasting bond returns would be very easy if we could simply equate yield to maturity with expected return. It is not that simple, but YTM does provide a reasonable and readily available first approximation.

² Bear in mind that yield to maturity does not account for optionality. However, various yield measures derived from option-adjusted valuation can be viewed as conveying similar information. To keep the present discussion as simple as possible, we ignore the distinction here. If optionality is critical to the forecast, it may be necessary to apply the more granular DCF framework discussed previously.

Assuming cash flows are received in full and on time, there are two main reasons why realized return may not equal the initial yield to maturity. First, if the investment horizon is shorter than the amount of time until the bond's maturity, any change in interest rate (i.e., the bond's YTM) will generate a capital gain or loss at the horizon. Second, the cash flows may be reinvested at rates above or below the initial YTM. The longer the horizon, the more sensitive the realized return will be to reinvestment rates. These two issues work in opposite directions: Rising (falling) rates induce capital losses (gains) but increase (decrease) reinvestment income. If the investment horizon equals the (Macaulay) duration of the bond or portfolio, the capital gain/loss and reinvestment effects will roughly offset, leaving the realized return close to the original YTM. This relationship is exact if (a) the yield curve is flat and (b) the change in rates occurs immediately in a single step. In practice, the relationship is only an approximation. Nonetheless, it provides an important insight: *Over horizons shorter than the duration, the capital gain/loss impact will tend to dominate such that rising (declining) rates imply lower (higher) return, whereas over horizons longer than the duration, the reinvestment impact will tend to dominate such that rising (declining) rates imply higher (lower) return.*

Note that the timing of rate changes matters. It will not have much effect, if any, on the capital gain/loss component because that ultimately depends on the beginning and ending values of the bond or portfolio. But it does affect the reinvestment return. The longer the horizon, the more it matters. Hence, for long-term forecasts, we should break the forecast horizon into subperiods corresponding to when we expect the largest rate changes to occur.

EXAMPLE 1

Forecasting Return Based on Yield to Maturity

Jesper Bloch works for Discrete Asset Management (DAM) in Zurich. Many of the firm's more risk-averse clients invest in a currency-hedged global government bond strategy that uses cash flows to purchase new issues and seasoned bonds all along the yield curve to maintain a roughly constant maturity and duration profile. The yield to maturity of the portfolio is 3.25% (compounded annually), and the modified duration is 4.84. DAM's chief investment officer believes global government yields are likely to rise by 200 bps over the next two years as central banks remove extraordinarily accommodative policies and inflation surges. Bloch has been asked to project approximate returns for this strategy over horizons of two, five, and seven years. What conclusions is Bloch likely to draw?

Solution:

If yields were not expected to change, the return would be very close to the yield to maturity (3.25%) over each horizon. The Macaulay duration is 5.0 ($= 4.84 \times 1.0325$), so if the yield change occurred immediately, the capital gain/loss and reinvestment impacts on return would roughly balance over five years. Ignoring convexity (which is not given), the capital loss at the end of two years will be approximately 9.68% ($= 4.84 \times 2\%$). Assuming yields rise linearly over the initial two-year period, the higher reinvestment rates will boost the cumulative return by approximately 1.0% over two years, so the annual return over two years will be approximately $-1.09\% [= 3.25 + (-9.68 + 1.0)/2]$. Reinvesting for three more years at the 2.0% higher rate adds another 6.0% to the cumulative return, so the five-year annual return would be approximately 2.71% [$= 3.25 + (-9.68 + 1.0 + 6.0)/5$]. With an additional two years of reinvestment income, the seven-year annual return would be about 3.44% [$= 3.25 + (-9.68 + 1.0 + 6.0 + 4.0)/7$]. As expected, the capital loss dominated the return over two years, and higher

reinvestment rates dominated over seven years. The gradual nature of the yield increase extended the horizon over which the capital gain/loss and reinvestment effects would balance beyond the initial five-year Macaulay duration.

We have extended the DCF approach beyond simply finding the discount rates implied by current market prices (e.g., YTMs), which might be considered the “pure” DCF approach. For other asset classes (e.g., equities), the connection between discount rates and valuations/returns is vague because there is so much uncertainty with respect to the cash flows. For these asset classes, discounted cash flow is essentially a conceptual framework rather than a precise valuation model. In contrast, in fixed income there is a tight connection between discount rates, valuations, and returns. We are, therefore, able to refine the “pure” DCF forecast by incorporating projections of how rates will evolve over the investment horizon. Doing so is particularly useful in formulating short-term forecasts.

3.2 The Building Block Approach to Fixed-Income Returns

The building block approach forms an estimate of expected return in terms of required compensation for specific types of risk. The required return for fixed-income asset classes has four components: the one-period default-free rate, the term premium, the credit premium, and the liquidity premium. As the names indicate, the premiums reflect compensation for interest rate risk, duration risk, credit risk, and illiquidity, respectively. Only one of the four components—the short-term default-free rate—is (potentially) observable. For example, the term premium and the credit premium are implicitly embedded in yield spreads, but they are not *equal* to observed yield spreads. Next, we will consider each of these components and summarize applicable empirical regularities.

3.2.1 The Short-term Default-free Rate

In principle, the short-term default-free rate is the rate on the highest-quality, most liquid instrument with a maturity that matches the forecast horizon. In practice, it is usually taken to be a government zero-coupon bill at a maturity that is issued frequently—say, every three months. This rate is virtually always tied closely to the central bank’s policy rate and, therefore, mirrors the cyclical dynamics of monetary policy. Secular movements are closely tied to expected inflation levels.

Under normal circumstances, the observed rate is a reasonable base on which to build expected returns for risky assets. In extreme circumstances, however, it may be necessary to adopt a normalized rate. For example, when policy rates or short-term government rates are negative, using the observed rate without adjustment may unduly reduce the required/expected return estimate for risky instruments. An alternative to normalizing the short rate in this circumstance would be to raise the estimate of one or more of the risk premiums on the basis of the notion that the observed negative short rate reflects an elevated willingness to pay for safety or, conversely, elevated required compensation for risk.

Forecast horizons substantially longer than the maturity of the standard short-term instrument call for a different type of adjustment. There are essentially two approaches. The first is to use the yield on a longer zero-coupon bond with a maturity that matches the horizon. In theory, that is the right thing to do. It does, however, call into question the role of the term premium since the longer-term rate will already incorporate the term premium. The second approach is to replace today’s observed short-term rate with an estimate of the return that would be generated by rolling the short-term instrument over the forecast horizon; that is, take account of the likely path of short-term rates. This approach does not change the interpretation of

the term premium. In addition to helping establish the baseline return to which risk premiums will be added, explicitly projecting the path of short-term rates may help in estimating the term premium.

In many markets, there are futures contracts for short-term instruments. The rates implied by these contracts are frequently interpreted as the market's expected path of short-term rates. As such, they provide an excellent starting point for analysts in formulating their own projections. Some central banks—for example, the US Federal Reserve Board—publish projections of future policy rates that can also serve as a guide for analysts. Quantitative models, such as the Taylor rule, provide another tool.³

3.2.2 The Term Premium

The default-free spot rate curve reflects the expected path of short-term rates and the required term premiums for each maturity. It is tempting to think that given a projected path of short-term rates, we can easily deduce the term premiums from the spot curve. We can, of course, derive a set of forward rates in the usual way and subtract the projected short-term rate for each future period. Doing so would give an implied sequence of period-by-period premiums. This may be a useful exercise, but it will not give us what we really want—the expected returns for bonds of different maturities over our forecast horizon. The implication is that although the yield curve contains the information we want and may be useful in forecasting returns, we cannot derive the term premium directly from the curve itself.

A vast amount of academic research has been devoted over many decades to addressing three fundamental questions: Do term premiums exist? If so, are they constant? And if they exist, how are they related to maturity? The evidence indicates that term premiums are positive and increase with maturity, are roughly proportional to duration, and vary over time. The first of these properties implies that term premiums are important. The second allows the analyst to be pragmatic, focusing on a single term premium, which is then scaled by duration. The third property implies that basing estimates on current information is essential.

Ilmanen (2012) argued that there are four main drivers of the term premium for nominal bonds.

- *Level-dependent inflation uncertainty:* Inflation is arguably the main driver of long-run variation in both nominal yields and the term premium. Higher (lower) levels of inflation tend to coincide with greater (less) inflation uncertainty. Hence, nominal yields rise (fall) with inflation because of changes in both expected inflation and the inflation risk component of the term premium.
- *Ability to hedge recession risk:* In theory, assets earn a low (or negative) risk premium if they tend to perform well when the economy is weak. When growth and inflation are primarily driven by aggregate demand, nominal bond returns tend to be negatively correlated with growth and a relatively low term premium is warranted. Conversely, when growth and inflation are primarily driven by aggregate supply, nominal bond returns tend to be positively correlated with growth, necessitating a higher term premium.

³ See the Capital Market Expectations Part 1 reading for discussion of the Taylor rule.

- *Supply and demand:* The relative outstanding supply of short-maturity and long-maturity default-free bonds influences the slope of the yield curve.⁴ This phenomenon is largely attributable to the term premium since the maturity structure of outstanding debt should have little impact on the expected future path of short-term rates.⁵
- *Cyclical effects:* The slope of the yield curve varies substantially over the business cycle: It is steep around the trough of the cycle and flat or even inverted around the peak. Much of this movement reflects changes in the expected path of short-term rates. However, it also reflects countercyclical changes in the term premium.

Although the slope of the yield curve is useful information on which to base forecasts of the term premium, other indicators work as well or better. Exhibit 1 shows correlations with subsequent excess bond returns (7- to 10-year Treasury bond return minus 3-month Treasury bill return) over 1-quarter, 1-year, and 5-year horizons for eight indicators. The indicators are listed in descending order of the (absolute value of the) correlation with one-year returns. The first four are derived from the bond market. The *ex ante* real yield has the strongest relationship over each horizon. Next on the list are the two most complex indicators. The Cochrane and Piazzesi curve factor is a composite measure capturing both the slope and the curvature of the yield curve.⁶ The Kim and Wright premium is derived from a three-factor term structure model.⁷ The slope of the yield curve is next on the list. Note that it has the weakest relationship over the five-year horizon. The supply indicator—the share of debt with maturity greater than 10 years—has a particularly strong relationship over the longest horizon. Since this variable tends to change gradually over time, it is not surprising that it is more closely related to long-run average returns than it is to shorter-term returns. The three cyclical proxies—the corporate profit-to-GDP ratio, business confidence, and the unemployment rate—are at the bottom of the list since they had the weakest correlation with return over the next year.

Exhibit 1 Correlations with Future Excess Bond Returns, 1962–2009

Current Indicator	Return Horizon		
	1 Quarter	1 Year	5 Years
<i>Ex ante</i> real yield	0.28	0.48	0.69
Cochrane and Piazzesi curve factor	0.24	0.44	0.32
Kim and Wright model premium*	0.25	0.43	0.34
Yield curve slope (10 year – 3 month)	0.21	0.34	0.06
Share of debt > 10 years	0.13	0.28	0.66
Corporate profit/GDP	-0.13	-0.25	-0.52

⁴ As discussed in the Capital Market Expectations Part 1 reading, temporary changes in the relative flow of bonds to the market may not have a lasting impact on the curve unless they result in a significant, permanent change in the amounts outstanding.

⁵ Supply/demand effects will be more pronounced if there are reasons for certain investors to prefer or require bonds of specific maturities. This is most likely to occur at the very long end of the curve because the supply of very long-term bonds is typically limited and some institutions must fund very long-term liabilities. As an example, the long end of the UK curve was severely squeezed in the 1990s.

⁶ See Cochrane and Piazzesi (2005).

⁷ See Kim and Wright (2005). The three factors in the theoretical model do not correspond directly with observable variables but may be thought of as proxies for the level, slope, and curvature of the term structure.

Exhibit 1 (Continued)

Current Indicator	Return Horizon		
	1 Quarter	1 Year	5 Years
ISM business confidence	-0.10	-0.20	-0.30
Unemployment rate	0.11	0.18	0.24

* Kim and Wright model results are for 1990–2009.

Source: Ilmanen (2012, Exhibit 3.14).

3.2.3 The Credit Premium

The credit premium is the additional expected return demanded for bearing the risk of default losses—importantly, in addition to compensation for the *expected* level of losses. Both expected default losses and the credit premium are embedded in credit spreads. They cannot be recovered from those spreads unless we impose some structure (i.e., a model) on default-free rates, default probabilities, and recovery rates. The two main types of models—structural credit models and reduced-form credit models—are described in detail in other readings.⁸ In the following discussion, we will focus on the empirical behavior of the credit premium.

An analysis of 150 years of defaults among US non-financial corporate bonds showed that the severity of default losses accounted for only about half of the 1.53% average yield spread.⁹ Hence, holders of corporate bonds did, on average, earn a credit premium to bear the risk of default. However, the pattern of actual defaults suggests the premium was earned very unevenly over time. In particular, high and low default rates tended to persist, causing clusters of high and low annual default rates and resultant losses. The study found that the previous year's default rate, stock market return, stock market volatility, and GDP growth rate were predictive of the subsequent year's default rate. However, the aggregate credit spread was not predictive of subsequent defaults. Contemporaneous financial market variables—stock returns, stock volatility, and the riskless rate—were significant in explaining the credit spread, but neither GDP growth nor changes in the default rate helped explain the credit spread. This finding suggests that credit spreads were driven primarily by the credit risk premium and financial market conditions and only secondarily by fundamental changes in the expected level of default losses. Thus, credit spreads do contain information relevant to predicting the credit premium.

Ilmanen (2012) hypothesized that credit spreads and the credit premiums embedded in them are driven by different factors, depending on credit quality. Default rates on top-quality (AAA and AA) bonds are extremely low, so very little of the spread/premium is due to the likelihood of actual default in the absence of a change in credit quality. Instead, the main driver is “downgrade bias”—the fact that a deterioration in credit quality (resulting in a rating downgrade) is much more likely than an improvement in credit quality (leading to an upgrade) and that downgrades induce larger spread changes than upgrades do.¹⁰ Bonds rated A and BBB have moderate default rates. They still do not have a high likelihood of actual default losses, but their prospects are more

⁸ See the CFA Program curriculum reading “Credit Analysis Models.” More in-depth coverage can be found in Jarrow and van Deventer (2015).

⁹ See Giesecke, Longstaff, Schaefer, and Strebulaev (2011). Default rates were measured as a fraction of the par value of outstanding bonds. The authors did not document actual recovery rates, instead assuming 50% recovery. Hence, the true level of losses could have been somewhat higher or lower.

¹⁰ Liquidity relative to government bonds is also an important contributor to yield spreads on very high-quality private sector bonds. By definition, of course, this is really the liquidity premium, rather than part of the credit premium.

sensitive to cyclical forces and their spreads/premiums vary more (countercyclically) over the cycle. Default losses are of utmost concern for below-investment-grade bonds. Defaults tend to cluster in times when the economy is in recession. In addition, the default rate and the severity of losses in default tend to rise and fall together. These characteristics imply big losses at the worst times, necessitating substantial compensation for this risk. Not too surprisingly, high-yield spreads/premiums tend to rise ahead of realized default rates.

Exhibit 2 shows three variables that have tended to predict excess returns (over T-bills) for an index of US investment-grade corporate bonds over the next quarter and the next year. Not surprisingly, a high corporate option-adjusted spread is bullish for corporate bond performance because it indicates a large cushion against credit losses—that is, a higher credit premium. A steep Treasury curve is also bullish because, as mentioned earlier, it tends to correspond to the trough of the business cycle when default rates begin to decline. Combining these insights with those from Exhibit 1, the implication is that a steep yield curve predicts both a high term premium and a high credit premium. Higher implied volatility in the equity market was also bullish for corporates, most likely reflecting risk-averse pricing—that is, high risk premiums—across all markets.

**Exhibit 2 Correlations with US Investment-Grade Corporate Excess Returns,
1990–2009**

Current Indicator	Return Horizon	
	1 Quarter	1 Year
Corporate option-adjusted spread	0.25	0.46
VIX implied equity volatility	0.28	0.39
Yield curve slope (10 year – 2 year)	0.20	0.27

Source: Ilmanen (2012, Exhibit 4.15).

How are credit premiums related to maturity? Aside from situations of imminent default, there is greater risk of default losses the longer one must wait for payment. We might, therefore, expect that longer-maturity corporate bonds would offer higher credit risk premiums. The historical evidence suggests that this has not been the case. Credit premiums tend to be especially generous at the short end of the curve. This may be due to “event risk,” in the sense that a default, no matter how unlikely, could still cause a huge proportional loss but there is no way that the bond will pay more than the issuer promised. It may also be due, in part, to illiquidity since many short-maturity bonds are old issues that rarely trade as they gradually approach maturity. As a result, many portfolio managers use a strategy known as a “credit barbell” in which they concentrate credit exposure at short maturities and take interest rate/duration risk via long-maturity government bonds.

3.2.4 The Liquidity Premium

Relatively few bond issues trade actively for more than a few weeks after issuance. Secondary market trading occurs primarily in the most recently issued sovereign bonds, current coupon mortgage-backed securities, and a few of the largest high-quality corporate bonds. The liquidity of other bonds largely depends on the willingness of dealers to hold them in inventory long enough to find a buyer. In general, liquidity tends to be better for bonds that are (a) priced near par/reflective of current market levels, (b) relatively new, (c) from a relatively large issue, (d) from a well-known/

frequent issuer, (e) standard/simple in structure, and (f) high quality. These factors tend to reduce the dealer's risk in holding the bond and increase the likelihood of finding a buyer quickly.

As a baseline estimate of the "pure" liquidity premium in a particular market, the analyst can look to the yield spread between fixed-rate, option-free bonds from the highest-quality issuer (virtually always the sovereign) and the next highest-quality large issuer of similar bonds (often a government agency or quasi-agency). Adjustments should then be made for the factors listed previously. In general, the impact of each factor is likely to increase disproportionately as one moves away from baseline attributes. For example, each step lower in credit quality is likely to have a bigger impact on liquidity than that of the preceding step.

EXAMPLE 2

Fixed-Income Building Blocks

Salimah Rahman works for SMECo, a Middle Eastern sovereign wealth fund. Each year, the fund's staff updates its projected returns for the following year on the basis of developments in the preceding year. The fund uses the building block approach in making its fixed-income projections. Rahman has been assigned the task of revising the key building block components for a major European bond market. The following table shows last year's values:

	Description	Value
Risk-free rate	3-month government bill	3.50%
Term premium	5-year duration	0.50%
Credit premium	Baa/BBB corporate	0.90%
Liquidity premium	Government-guaranteed agency	0.15%

Although inflation rose modestly, the central bank cut its policy rate by 50 bps in response to weakening growth. Aggregate corporate profits have remained solid, and after a modest correction, the stock market finished higher for the year. However, defaults on leveraged loans were unexpectedly high this year, and confidence surveys weakened again recently. Equity option volatility spiked mid-year but ended the year somewhat lower. The interest rate futures curve has flattened but remains upward sloping. The 10-year government yield declined only a few basis points, while the yield on comparable government agency bonds remained unchanged and corporate spreads—both nominal and option adjusted—widened.

Indicate the developments that are likely to cause Rahman to increase/decrease each of the key building blocks relative to last year.

Guideline answer:

Based on the reduction in policy rates and the flattening of the interest rate futures curve, Rahman is virtually certain to reduce the short-term rate component. Steepening of the yield curve (10-year yield barely responded to the 50 bp rate cut) indicates an increase in both the term premium and the credit premium. Declining confidence also suggests a higher term premium. Widening of credit spreads is also indicative of a higher credit premium. However, the increase in loan defaults suggests that credit losses are likely to be higher next year as well, since defaults tend to cluster. All else the same, this reduces the expected return on corporate bonds/loans. Hence, the credit premium should increase less than would otherwise be implied by the steeper yield curve and wider credit spreads. Modest widening of the government agency spread indicates an increase in the

liquidity premium. The resilience of the equity market and the decline in equity option volatility suggest that investors are not demanding a general increase in risk premiums.

3.3 Risks in Emerging Market Bonds

Emerging market debt was once nearly synonymous with crisis. The Latin American debt crisis of the 1980s involved bank loans but essentially triggered development of a market for emerging market bonds. In the early 1990s, the Mexican crisis occurred. In the late 1990s, there was the Asian crisis, followed by the Russian crisis, which contributed to the turmoil that sank the giant hedge fund Long-Term Capital Management. There have been other, more isolated, events, such as Argentina's forced restructuring of its debt, but the emerging market bond market has grown, deepened, and matured. What started with only a few government issuers borrowing in hard currencies (from their perspective foreign, but widely used, currencies) has grown into a market in which corporations as well as governments issue in their local currencies and in hard currencies. The discussion here applies not just to emerging markets but also to what are known as "frontier" markets (when they are treated separately or as a subset of emerging markets).

Investing in emerging market debt involves all the same risks as investing in developed country debt, such as interest rate movements, currency movements, and potential defaults. In addition, it poses risks that are, although not entirely absent, less significant in developed markets. These risks fall roughly into two categories: (1) economic and (2) political and legal. A slightly different breakdown would be "ability to pay" and "willingness to pay."

Before discussing these country risks, note that some countries that are labeled as emerging markets may in fact be healthy, prosperous economies with strong fundamentals. Likewise, the political and legal issues discussed in this section may or may not apply to any particular country. Furthermore, these risks will, in general, apply in varying degrees across countries. Emerging markets are widely recognized as a very heterogeneous group. It is up to the analyst to assess which considerations are relevant to a particular investment decision.

Economic Risks/Ability to Pay

Emerging market economies as a whole have characteristics that make them potentially more vulnerable to distress and hence less likely to be able to pay their debts on time or in full, such as the following:

- Greater concentration of wealth and income; less diverse tax base
- Greater dependence on specific industries, especially cyclical industries, such as commodities and agriculture; low potential for pricing power in world markets
- Restrictions on trade, capital flows, and currency conversion
- Poor fiscal controls and monetary discipline
- Less educated and less skilled work force; poor or limited physical infrastructure; lower level of industrialization and technological sophistication
- Reliance on foreign borrowing, often in hard currencies not their own
- Small/less sophisticated financial markets and institutions
- Susceptibility to capital flight; perceived vulnerability contributing to actual vulnerability

Although history is at best an imperfect guide to the future, the analyst should examine a country's track record on critical issues. Have there been crises in the past? If so, how were they handled/resolved? Has the sovereign defaulted? Is there restructured debt? How have authorities responded to fiscal challenges? Is there inflation or currency instability?

The analyst should, of course, examine the health of the macroeconomy in some detail. A few indicative guidelines can be helpful. If there is one ratio that is most closely watched, it is the ratio of the fiscal deficit to GDP. Most emerging countries have deficits and perpetually struggle to reduce them. A persistent ratio above 4% is likely a cause for concern. A debt-to-GDP ratio exceeding 70%–80%, perhaps of only mild concern for a developed market, is a sign of vulnerability for an emerging market. A persistent annual real growth rate less than 4% suggests that an emerging market is catching up with more advanced economies only slowly, if at all, and per capita income might even be falling—a potential source of political stress. Persistent current account deficits greater than 4% of GDP probably indicate lack of competitiveness. Foreign debt greater than 50% of GDP or greater than 200% of current account receipts is also a sign of danger. Finally, foreign exchange reserves less than 100% of short-term debt is risky, whereas a ratio greater than 200% is ample. It must be emphasized that the numbers given here are merely suggestive of levels that may indicate a need for further scrutiny.

When all else fails, a country may need to call on external support mechanisms. Hence, the analyst should consider whether the country has access to support from the International Monetary Fund (IMF), the World Bank, or other international agencies.

Political and Legal Risks/Willingness to Pay

Investors in emerging market debt may be unable to enforce their claims or recover their investments. Weak property rights laws and weak enforcement of contract laws are clearly of concern in this regard. Inability to enforce seniority structures within private sector claims is one important example. The principle of sovereign immunity makes it very difficult to force a sovereign borrower to pay its debts. Confiscation of property, nationalization of companies, and corruption are also relevant hazards. Coalition governments may also pose political instability problems. Meanwhile, the imposition of capital controls or restrictions on currency conversion may make it difficult, or even impossible, to repatriate capital.

As with economic risks, history may provide some guidance with respect to the severity of political and legal risks. The following are some pertinent questions: Is there a history of nationalization, expropriation, or other violations of property rights? How have international disputes been resolved and under which legal jurisdiction? Has the integrity of the judicial system and process been questioned? Are political institutions stable? Are they recognized as legitimate and subject to reasonable checks and balances? Has the transfer of power been peaceful, orderly, and lawful? Does the political process give rise to fragile coalitions that collapse whenever events strain the initial compromises with respect to policy?

EXAMPLE 3

Emerging Market Bonds

Belvia has big aspirations. Although still a poor country, it has been growing rapidly, averaging 6% real and 10% nominal growth for the last five years. At the beginning of this period of growth, a centrist coalition gained a narrow majority over the authoritarian, fiscally irresponsible, anti-investor, anti-business party that had been in power for decades. The government has removed the old barriers to trade, including the signing of a regional free-trade agreement, and

removed capital controls. Much of its growth has been fueled by investment in its dominant industry—natural resources—financed by debt and foreign direct investment flows. These policies have been popular with the business community, as has the relaxation of regulations affecting key constituencies. Meanwhile, to ensure that prosperity flows rapidly to the people, the government has allowed redistributive social payments to grow even faster than GDP, resulting in a large and rising fiscal deficit (5% of GDP this year, projected to be 7% in two years). The current account deficit is 8% of GDP. Despite the large current account deficit, the local currency has appreciated significantly since it was allowed to float two years ago. The government has just announced that it will issue a large 10-year local currency bond under Belvian law—the first issue of its kind in many years.

Despite a very strong relationship with the bank marketing the bond, Peter Valt has decided not to invest in it. When pressed for his reasoning, what risks is he likely to identify?

Solution:

There are several significant risks and warning signs. Coalition governments are often unstable, and the most likely alternative would appear to be a return to the previously dominant party that lacks fiscal discipline. That regime is likely to undo the recent pro-growth policies and might even disavow the debt, including this new bond. The bond will be governed by Belvian law, which, combined with the principle of sovereign immunity, will make it very difficult for foreigners to enforce their claims. In addition, the relaxation of regulations affecting key constituencies hints strongly at corruption and possibly at payoffs within the current regime. With respect to the economy, fiscal discipline remains poor, there is heavy reliance on a single industry, and the current account deficit is almost certainly unsustainable (e.g., over the 10-year life of this bond). In addition, the currency is very likely to be overvalued, which will both make it very difficult to broaden global competitiveness beyond natural resources and increase the investor's risk of substantial currency losses.

4

FORECASTING EQUITY RETURNS

The task of forecasting equity market returns is often the central focus of setting capital market expectations. In this section, we discuss applying each of the major methodologies to equities.

4.1 Historical Statistics Approach to Equity Returns

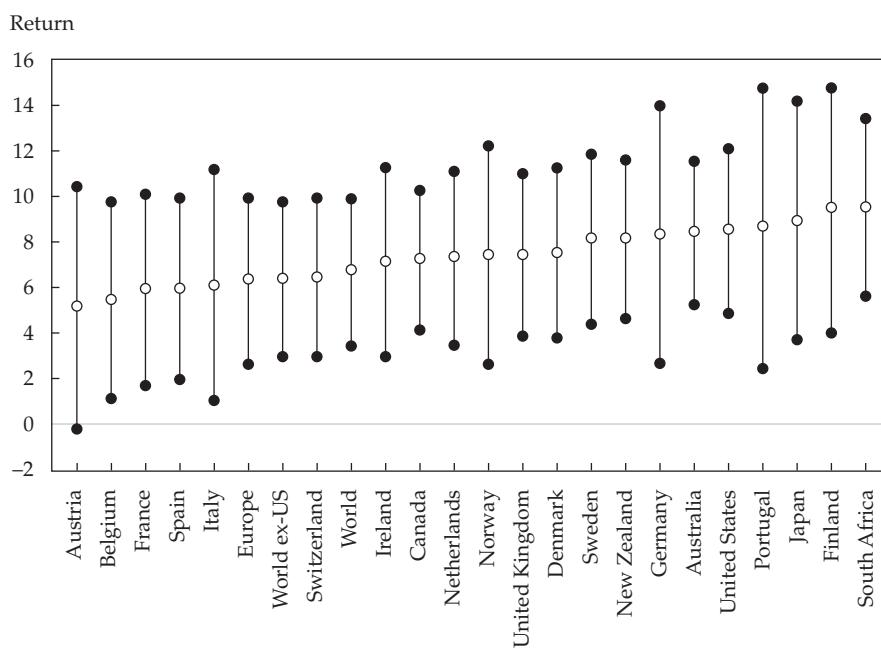
The *Credit Suisse Global Investment Returns Yearbook 2018*¹¹ updated the seminal work of Dimson, Marsh, and Staunton (2002) to include asset returns in 21 countries for the 118-year period of 1900–2017. Exhibit 3 shows the mean real return for each market portfolio centered within a 95% confidence interval. Results are also shown for a world portfolio, a world ex-US portfolio, and Europe. The portfolios are ordered from left to right on the basis of the mean return.

The means range from a low of 5.0% for Austria to a high of 9.4% in South Africa. Note that both of these values lie within the confidence interval for every country. From a statistical perspective, there is really no difference among these markets in

¹¹ Dimson, Marsh, and Staunton (2018).

terms of mean real return. This illustrates the fact that sample averages, even derived from seemingly long histories, are very imprecise estimates unless the volatility of the data is small relative to the mean. Clearly that is not the case for equity returns. Nonetheless, sample means are frequently cited without regard to the quality of information they convey.

Exhibit 3 Historical Mean Returns with Confidence Intervals by Country, 1900–2017



Source: Dimson, Marsh, and Staunton (2018, Chapter 1, Table 1. Real, local currency percent returns).

As indicated in Section 2, shrinkage estimators can often provide more reliable estimates by combining the sample mean with a second estimate of the mean return. However, the application of a common shrinkage estimator confirms that there is no basis for believing that the true expected returns for the countries in Exhibit 3 are different.

4.2 DCF Approach to Equity Returns

Analysts have frequently used the Gordon (constant) growth model form of the dividend discount model, solved for the required rate of return, to formulate the long-term expected return of equity markets. Although this model is quite simple, it has a big advantage over using historical stock returns to project future returns. The vast majority of the “noise” in historical stock returns comes from fluctuations in the price-to-earnings ratio (P/E) and the ratio of earnings to GDP. Since the amount of earnings appears in the numerator of one ratio and the denominator of the other, the impact of these ratios tends to cancel out over time, leaving the relationship between equity market appreciation and GDP growth much more stable. And GDP growth itself, especially the real growth component, is much less volatile and hence relatively

predictable.¹² As an illustration, Exhibit 4 shows historical volatilities (defined as the standard deviation of percentage changes) for the S&P 500 Index return, P/E, the earnings-to-GDP ratio, real US GDP growth, and inflation for 1946–2016. The Gordon growth model allows us to take advantage of this relative stability by linking long-term equity appreciation to a more stable foundation—economic growth.

Exhibit 4 Historical Comparison of Standard Deviations in the United States, 1946–2016

S&P 500	P/E	Earnings/GDP	Real GDP Growth	Inflation
16.1	28.5	28.9	3.0	3.2

Note: Standard deviation of % changes

In the United States and other major markets, share repurchases have become an important way for companies to distribute cash to shareholders. Grinold and Kroner (2002) provided a restatement of the Gordon growth model that takes explicit account of repurchases. Their model also provides a means for analysts to incorporate expectations of valuation levels through the familiar price-to-earnings ratio. The **Grinold–Kroner model**¹³ is

$$E(R_e) \approx \frac{D}{P} + (\% \Delta E - \% \Delta S) + \% \Delta P/E \quad (1)$$

where $E(R_e)$ is the expected equity return, D/P is the dividend yield, $\% \Delta E$ is the expected percentage change in total earnings, $\% \Delta S$ is the expected percentage change in shares outstanding, and $\% \Delta P/E$ is the expected percentage change in the price-to-earnings ratio. The term in parentheses, $(\% \Delta E - \% \Delta S)$, is the growth rate of earnings per share. Net share repurchases ($\% \Delta S < 0$) imply that earnings per share grows faster than total earnings.

With a minor rearrangement of the equation, the expected return can be divided into three components:

- Expected cash flow (“income”) return: $D/P - \% \Delta S$
- Expected nominal earnings growth return: $\% \Delta E$
- Expected repricing return: $\% \Delta P/E$

The expected nominal earnings growth return and the expected repricing return constitute the expected capital gains.

In principle, the Grinold–Kroner model assumes an infinite horizon. In practice, the analyst typically needs to make projections for finite horizons, perhaps several horizons. In applying the model, the analyst needs to be aware of the implications of constant growth rate assumptions over different horizons. Failure to tailor growth rates to the horizon can easily lead to implausible results. As an example, suppose the P/E is currently 16.0 and the analyst believes that it will revert to a level of 20 and be stable thereafter. The P/E growth rates for various horizons that are consistent with this view are 4.56% for 5 years, 2.26% for 10 years, 0.75% for 30 years, and an arbitrarily small positive number for a truly long-term horizon. Treating, say, the 2.26% 10-year number as if it is appropriate for the “long run” would imply an ever-rising P/E rather than convergence to a plausible long-run valuation. The only very long-run

¹² See the previous reading for a discussion of projecting trend growth.

¹³ See Grinold and Kroner (2002) for a derivation. The model is shown here in a slightly modified form.

assumptions that are consistent with economically plausible relationships are $\% \Delta E = \text{Nominal GDP growth}$, $\% \Delta S = 0$, and $\% \Delta P/E = 0$. The longer the (finite) horizon, the less the analyst's projection should deviate from these values.

EXAMPLE 4

Forecasting the Equity Return Using the Grinold–Kroner Model

Cynthia Casey uses the Grinold–Kroner model in forecasting developed market equity returns. Casey makes the following forecasts:

- a 2.25% dividend yield on Canadian equities, based on the S&P/TSE Composite Index;
 - a 1% rate of net share repurchases for Canadian equities;
 - a long-term corporate earnings growth rate of 6% per year, based on a 1 percentage point (pp) premium for corporate earnings growth over her expected Canadian (nominal) GDP growth rate of 5%; and
 - an expansion rate for P/E multiples of 0.25% per year.
- 1 Based on the information given, what expected rate of return on Canadian equities is implied by Casey's assumptions?
 - 2 Are Casey's assumptions plausible for the long run and for a 10-year horizon?

Solution to 1:

The expected rate of return on Canadian equities based on Casey's assumptions would be 9.5%, calculated as

$$E(R_e) \approx 2.25\% + [6.0\% - (-1.0\%)] + 0.25\% = 9.5\%.$$

Solution to 2:

Casey's assumptions are not plausible for the very long run. The assumption that earnings will grow 1% faster than GDP implies one of two things: either an ever-rising ratio of economy-wide earnings to GDP or the earnings accruing to businesses not included in the index (e.g., private firms) continually shrinking relative to GDP. Neither is likely to persist indefinitely. Similarly, perpetual share repurchases would eventually eliminate all shares, whereas a perpetually rising P/E would lead to an arbitrarily high price per Canadian dollar of earnings per share. Based on Casey's economic growth forecast, a more reasonable long-run expected return would be $7.25\% = 2.25\% + 5.0\%$.

Casey's assumptions are plausible for a 10-year horizon. Over 10 years, the ratio of earnings to GDP would rise by roughly $10.5\% = (1.01)^{10} - 1$, shares outstanding would shrink by roughly $9.6\% = 1 - (0.99)^{10}$, and the P/E would rise by about $2.5\% = (1.0025)^{10} - 1$.

Most of the inputs to the Grinold–Kroner model are fairly readily available. Economic growth forecasts can easily be found in investment research publications, reports from such agencies as the IMF, the World Bank, and the OECD, and likely from the analyst firm's own economists. Data on the rate of share repurchases are less straightforward but are likely to be tracked by sell-side firms and occasionally mentioned in research publications. The big question is how to gauge valuation of the market in order to project changes in the P/E.

The fundamental valuation metrics used in practice typically take the form of a ratio of price to some fundamental flow variable—such as earnings, cash flow, or sales—with seemingly endless variations in how the measures are defined and calculated. Whatever the metric, the implicit assumption is that it has a well-defined long-run mean value to which it will revert. In statistical terms, it is a stationary random variable. Extensive empirical evidence indicates that these valuation measures are poor predictors of short-term performance. Over multi-year horizons, however, there is a reasonably strong tendency for extreme values to be corrected. Thus, these metrics do provide guidance for projecting intermediate-term movements in valuation.

Gauging what is or is not an extreme value is complicated by the fact that all the fundamental flow variables as well as stock prices are heavily influenced by the business cycle. One method of dealing with this issue is to “cyclically adjust” the valuation measure. The most widely known metric is the cyclically adjusted P/E (CAPE). For this measure, the current price level is divided by the average level of earnings for the last 10 years (adjusted for inflation), rather than by the most current earnings. The idea is to average away cyclical variation in earnings and provide a more reliable base against which to assess the current market price.

4.3 Risk Premium Approaches to Equity Returns

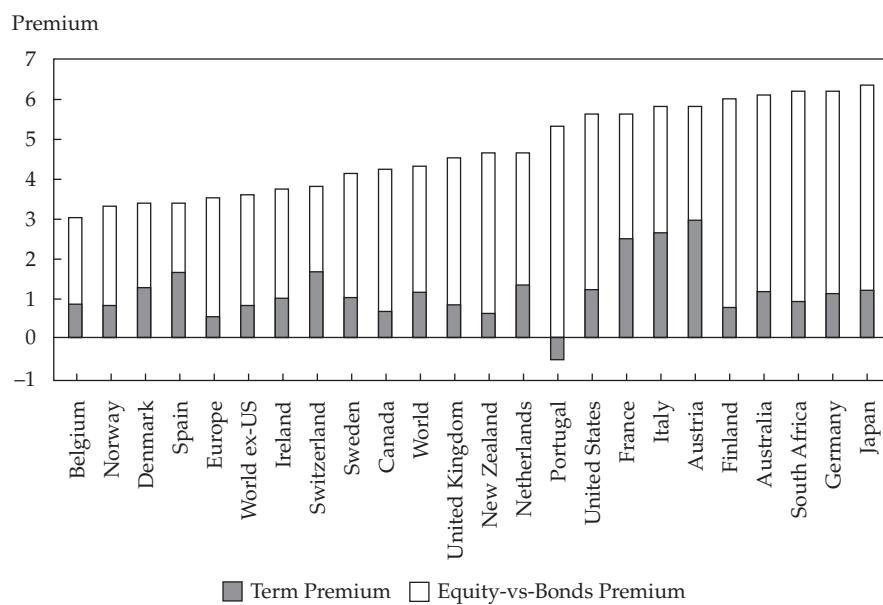
The Grinold–Kroner model and similar models are sometimes said to reflect the “supply” of equity returns since they outline the sources of return. In contrast, risk premiums reflect “demand” for returns.

4.3.1 Defining and Forecasting the Equity Premium

The term “equity premium” is most frequently used to describe the amount by which the expected return on equities exceeds the riskless rate (“equity versus bills”). However, the same term is sometimes used to refer to the amount by which the expected return on equities exceeds the expected return on default-free bonds (“equity versus bonds”). From the discussion of fixed-income building blocks in Section 3, we know that the difference between these two definitions is the term premium built into the expected return on default-free bonds. The equity-versus-bonds premium reflects an incremental/building block approach to developing expected equity returns, whereas the equity-versus-bills premium reflects a single composite premium for the risk of equity investment.

Exhibit 5 shows historical averages for both of these equity premium concepts by country for the period 1900–2017.¹⁴ For each country, the bottom portion of the column is the realized term premium (i.e., bonds minus bills) and the top segment is the realized equity-versus-bonds premium. The whole column represents the equity-versus-bills premium. The equity-versus-bills premiums range from 3.0% to 6.3%, the equity-versus-bonds premiums range from 1.8% to 5.2%, and the term premiums range from –0.6% to 2.9%.

¹⁴ These premiums reflect geometric returns. Therefore, the equity-vs-bills premium is the sum of the term premium and the equity-vs-bonds premium. Premiums using arithmetic returns are systematically higher and are not additive.

Exhibit 5 Historical Equity Premiums by Country, 1900–2017

Notes: Germany excludes 1922–1923. Austria excludes 1921–1922. Returns are shown in percentages.
 Source: Dimson et al. (2018, Chapter 2, Tables 8 and 9).

As with the mean equity returns in Exhibit 3, these historical premiums are subject to substantial estimation error. Statistically, there is no meaningful difference among them. Thus, the long-run cross section of returns/premiums provides virtually no reliable information with which to differentiate among countries.

Since equity returns are much more volatile than returns on either bills or bonds, forecasting either definition of the equity premium is just as difficult as projecting the absolute level of equity returns. That is, simply shifting to focus on risk premiums provides little, if any, specific insight with which to improve forecasts. The analyst must, therefore, use the other modes of analysis discussed here to forecast equity returns/premiums.

4.3.2 An Equilibrium Approach

There are various global/international extensions of the familiar capital asset pricing model (CAPM). We will discuss a version proposed by Singer and Terhaar (1997) that is intended to capture the impact of incomplete integration of global markets.

The Singer–Terhaar model is actually a combination of two underlying CAPM models. The first assumes that all global markets and asset classes are fully integrated. The full integration assumption allows the use of a single global market portfolio to determine equity-versus-bills risk premiums for all assets. The second underlying CAPM assumes complete segmentation of markets such that each asset class in each country is priced without regard to any other country/asset class. For example, the markets for German equities and German bonds are completely segmented. Clearly, this is a very extreme assumption.

Recall the basic CAPM pricing relationship:

$$RP_i = \beta_{i,M} RP_M \quad (2)$$

where $RP_i = [E(R_i) - R_F]$ is the risk premium on the i th asset, RP_M is the risk premium on the market portfolio, R_F is the risk-free rate, and $\beta_{i,M}$ —asset i 's sensitivity to the market portfolio—is given by

$$\beta_{i,M} = \frac{\text{Cov}(R_i, R_M)}{\text{Var}(R_M)} = \rho_{i,M} \left(\frac{\sigma_i}{\sigma_M} \right) \quad (3)$$

Standard deviations are denoted by σ , and ρ denotes correlation.

Under the assumption of full integration, every asset is priced relative to the global capitalization-weighted market portfolio. Using Equations 2 and 3 and denoting the global market portfolio by “GM,” the first component of the Singer–Terhaar model is

$$RP_i^G = \beta_{i,GM} RP_{GM} = \rho_{i,GM} \sigma_i \left(\frac{RP_{GM}}{\sigma_{GM}} \right) \quad (4)$$

A superscript “ G ” has been added on the asset's risk premium to indicate that it reflects the global equilibrium. The term in parentheses on the far right is the Sharpe ratio for the global market portfolio, the risk premium per unit of global market risk.

Now consider the case of completely segmented markets. In this case, the risk premium for each asset will be determined in isolation without regard to other markets or opportunities for diversification. The risk premium will be whatever is required to induce investors with access to that market/asset to hold the existing supply. In terms of the CAPM framework, this implies treating each asset as its own “market portfolio.” Formally, we can simply set β equal to 1 and ρ equal to 1 in the previous equations since each asset is perfectly correlated with itself. Using a superscript “ S ” to denote the segmented market equilibrium and replacing the global market portfolio with asset i itself in Equation 4, the segmented market equilibrium risk premium for asset i is

$$RP_i^S = 1 \times RP_i^S = 1 \times \sigma_i \left(\frac{RP_i^S}{\sigma_i} \right) \quad (5)$$

This is the second component of the Singer–Terhaar model. Note that the first equality in Equation 5 is an identity; it conveys no information. It reflects the fact that in a completely segmented market, the required risk premium could take any value. The second equality is more useful because it breaks the risk premium into two parts: the risk of the asset (σ_i) and the Sharpe ratio (i.e., compensation per unit of risk) in the segmented market.¹⁵

The final Singer–Terhaar risk premium estimate for asset i is a weighted average of the two component estimates

$$RP_i = \phi RP_i^G + (1 - \phi) RP_i^S \quad (6)$$

To implement the model, the analyst must supply values for the Sharpe ratios in the globally integrated market and the asset's segmented market; the degree to which the asset is globally integrated, denoted by ϕ ; the asset's volatility; and the asset's β with respect to the global market portfolio. A pragmatic approach to specifying the Sharpe ratios for each asset under complete segmentation is to assume that compensation for non-diversifiable risk (i.e., “market risk”) is the same in every market. That is, assume all the Sharpe ratios equal the global Sharpe ratio.

In practice, the analyst must make a judgment about the degree of integration/segmentation—that is, the value of ϕ in the Singer–Terhaar model. With that in mind, some representative values that can serve as starting points for refinement can be

¹⁵ A somewhat more complex model would allow for integration of asset classes within each country. Doing so would entail incorporating local market portfolios and allowing assets to be less than perfectly correlated with those portfolios. Equation (5) would then look exactly like equation (4) with the local segmented market portfolio replacing the global market portfolio (“GM”).

helpful. Developed market equities and bonds are highly integrated, so a range of 0.75–0.90 would be reasonable for ϕ . Emerging markets are noticeably less integrated, especially during stressful periods, and there are likely to be greater differences among these markets, so a range of 0.50–0.75 would be reasonable for emerging market equities and bonds. Real estate market integration is increasing but remains far behind developed market financial assets, perhaps on par with emerging market stocks and bonds overall. In general, relative real estate market integration is likely to reflect the relative integration of the associated financial markets. Commodities for which there are actively traded, high-volume futures contracts should be on the higher end of the integration scale.

To illustrate the Singer–Terhaar model, suppose that an investor has developed the following projections for German shares and bonds.

	German Shares	German Bonds
Volatility (σ_i)	17.0%	7.0%
Correlation with global market ($\rho_{i,M}$)	0.70	0.50
Degree of integration (ϕ)	0.85	0.85
Segmented market Sharpe ratio (RP_i^S / σ_i)	0.35	0.25

The risk-free rate is 3.0%, and the investor's estimate of the global Sharpe ratio is 0.30. Note that the investor expects compensation for undiversifiable risk to be higher in the German stock market and lower in the German bond market under full segmentation. The following are the fully integrated risk premiums for each of the assets (from Equation 4):

$$\text{Equities: } 0.70 \times 17.0\% \times 0.30 = 3.57\%.$$

$$\text{Bonds: } 0.50 \times 7.0\% \times 0.30 = 1.05\%.$$

The following are the fully segmented risk premiums (from Equation 5):

$$\text{Equities: } 17.0\% \times 0.35 = 5.95\%.$$

$$\text{Bonds: } 7.0\% \times 0.25 = 1.75\%.$$

Based on 85% integration ($\phi = 0.85$), the final risk estimates (from Equation 6) would be as follows:

$$\text{Equities: } (0.85 \times 3.57\%) + (1 - 0.85) \times 5.95\% = 3.93\%.$$

$$\text{Bonds: } (0.85 \times 1.05\%) + (1 - 0.85) \times 1.75\% = 1.16\%.$$

Adding in the risk-free rate, the expected returns for German shares and bonds would be 6.93% and 4.16%, respectively.

Virtually all equilibrium models implicitly assume perfectly liquid markets. Thus, the analyst should assess the actual liquidity of each asset class and add appropriate liquidity premiums. Although market segmentation and market liquidity are conceptually distinct, in practice they are likely to be related. Highly integrated markets are likely to be relatively liquid, and illiquidity is one reason that a market may remain segmented.

EXAMPLE 5**Using the Singer–Terhaar Model**

Stacy Adkins believes the equity market in one of the emerging markets that she models has become more fully integrated with the global market. As a result, she expects it to be more highly correlated with the global market. However, she thinks its overall volatility will decline. Her old and new estimates are as follows:

	Previous Data	New Data
Volatility (σ_i)	22.0%	18.0%
Correlation with global market ($\rho_{i,M}$)	0.50	0.70
Degree of integration (ϕ)	0.55	0.75
Sharpe ratio (global and segmented markets)	0.30	0.30

If she uses the Singer–Terhaar model, what will the net impact of these changes be on her risk premium estimate for this market?

Solution:

The segmented market risk premium will decline from 6.6% (calculated as $22.0\% \times 0.30 = 6.6\%$) to 5.4% ($= 18\% \times 0.30$). The fully integrated risk premium will increase from 3.30% ($= 0.50 \times 22.0\% \times 0.30$) to 3.78% ($= 0.70 \times 18.0\% \times 0.30$). The weighted average premium will decline from 4.79% [$= (0.55 \times 3.30\%) + (0.45 \times 6.60\%)$] to 4.19% [$= (0.75 \times 3.78\%) + (0.25 \times 5.40\%)$], so the net effect is a decline of 60 bps.

4.4 Risks in Emerging Market Equities

Most of the issues underlying the risks of emerging market (and “frontier market” if they are classified as such) bonds also present risks for emerging market equities: more fragile economies, less stable political and policy frameworks, and weaker legal protections. However, the risks take somewhat different forms because of the different nature of equity and debt claims. Again, note that emerging markets are a very heterogeneous group. The political, legal, and economic issues that are often associated with emerging markets may not, in fact, apply to a particular market or country being analyzed.

There has been a debate about the relative importance of “country” versus “industry” risk factors in global equity markets for over 40 years. The empirical evidence has been summarized quite accurately as “vast and contradictory.”¹⁶ Both matter, but on the whole, country effects still tend to be more important than (global) industry effects. This is particularly true for emerging markets. Emerging markets are generally less fully integrated into the global economy and the global markets. Hence, local economic and market factors exert greater influence on risk and return in these markets than in developed markets.

Political, legal, and regulatory weaknesses—in the form of weak standards and/or weak enforcement—affect emerging market equity investors in various ways. The standards of corporate governance may allow interested parties to manipulate the capital structure of companies and to misuse business assets. Accounting standards may allow management and other insiders to hide or misstate important information. Weak disclosure rules may also impede transparency and favor insiders. Inadequate

¹⁶ Marcelo, Quirós, and Martins (2013).

property rights laws, lack of enforcement, and weak checks and balances on governmental actions may permit seizure of property, nationalization of companies, and prejudicial and unpredictable regulatory actions.

Whereas the emerging market debt investor needs to focus on ability and willingness to pay specific obligations, emerging market equity investors need to focus on the many ways that the value of their ownership claims might be expropriated by the government, corporate insiders, or dominant shareholders.

EXAMPLE 6**Emerging Market Equity Risks**

Bill Dwight has been discussing investment opportunities in Belvia with his colleague, Peter Valt (see Example 3). He is aware that Valt declined to buy the recently issued government bond, but he believes the country's equities may be attractive. He notes the rapid growth, substantial investment spending, free trade agreement, deregulation, and strong capital inflows as factors favoring a strong equity market. In addition, solid global growth has been boosting demand for Belvia's natural resources. Roughly half of the public equity market is represented by companies in the natural resources sector. The other half is a reasonably diversified mix of other industries. Many of these firms remain closely held, having floated a minority stake on the local exchange in the last few years. Listed firms are required to have published two years of financial statements conforming to standards set by the Belvia Public Accounting Board, which is made up of the heads of the three largest domestic accounting firms. With the help of a local broker, Dwight has identified a diversified basket of stocks that he intends to buy.

Discuss the risks Dwight might be overlooking.

Guideline answer:

Dwight might be overlooking several risks. He is almost certainly underestimating the vulnerability of the local economy and the vulnerability of the equity market to local developments. The economy's rapid growth is being driven by a large and growing fiscal deficit, in particular, rapidly rising redistributive social payments, and investment spending financed by foreign capital. Appreciation of the currency has made industries other than natural resources less competitive, so the free trade agreement provides little support for the economy. When the government is forced to tighten fiscal policy or capital flows shrink, the domestic economy is likely to be hit hard. Political risk is also a concern. A return to the prior regime is likely to result in a less pro-growth, less business-friendly environment, which would most likely result in attempts by foreign investors to repatriate their capital. Dwight should also have serious concerns about corporate governance, given that most listed companies are closely held, with dominant shareholders posing expropriation risk. He should also be concerned about transparency (e.g., limited history available) and accounting standards (local standards set by the auditing firms themselves).

5

FORECASTING REAL ESTATE RETURNS

Real estate is inherently quite different from equities, bonds, and cash. It is a physical asset rather than a financial asset. It is heterogeneous, indivisible, and immobile. It is a factor of production, like capital equipment and labor, and as such, it directly produces a return in the form of services. Its services can be sold but can be used/consumed only in one location. Owning and operating real estate involves operating and maintenance costs. All these factors contribute to making real estate illiquid and costly to transfer. The characteristics just described apply to direct investment in real estate (raw land, which does not produce income, is an exception). We will address the investment characteristics of equity REITs versus direct real estate, but unless otherwise stated, the focus is on directly held, unlevered, income-producing real estate.

5.1 Historical Real Estate Returns

The heterogeneity, indivisibility, immobility, and illiquidity of real estate pose a severe problem for historical analysis. Properties trade infrequently, so there is virtually no chance of getting a sequence of simultaneous, periodic (say, quarterly) transaction prices for a cross section of properties. Real estate owners/investors must rely heavily on appraisals, rather than transactions, in valuing properties. Owing to infrequent transactions and the heterogeneity of properties, these appraisals tend to reflect slowly moving averages of past market conditions. As a result, returns calculated from appraisals represent weighted averages of (unobservable) “true” returns—returns that would have been observed if there had been transaction prices—in previous periods. This averaging does not, in general, bias the mean return. It does, however, significantly distort estimates of volatility and correlations. The published return series is too smooth; that is, the usual sample volatility substantially understates the true volatility of returns. Meanwhile, by disguising the timing of response to market information, the smoothing tends to underestimate the strength of contemporaneous correlation with other market variables and spuriously induce a lead/lag structure of correlations.

In order to undertake any meaningful analysis of real estate as an asset class, the analyst must first deal with this data issue. It has become standard to “unsmooth” appraisal-based returns using a time-series model. Such techniques, which also apply to private equity funds, private debt funds, and hedge funds, are briefly described in a later section.

5.2 Real Estate Cycles

Real estate is subject to cycles that both drive and are driven by the business cycle. Real estate is a major factor of production in the economy. Virtually every business requires it. Every household consumes “housing services.” Demand for the services provided by real estate rises and falls with the pace of economic activity. The supply of real estate is vast but essentially fixed at any point in time.¹⁷ As a result, there is a strong cyclical pattern to property values, rents, and occupancy rates. The extent to which this pattern is observable depends on the type of real estate. As emphasized previously, changes in property values are obscured by the appraisal process, although indications can be gleaned from transactions as they occur. The extent to which actual rents and occupancy rates fully reflect the balance of supply and demand depends primarily on the type of property and the quality of the property. High-quality properties

¹⁷ Yau, Schneeweis, Szado, Robinson, and Weiss (2018) found that real estate represents from one-third to as much as two-thirds of global wealth.

with long leases will tend to have little turnover, so fluctuations in actual rents and occupancy rates are likely to be relatively small. In contrast, demand for low-quality properties is likely to be more sensitive to the economy, leading to more substantial swings in occupancy and possibly rents as well. Properties with short leases will see rents adjust more completely to current supply/demand imbalances. Room rates and occupancy at low-quality hotels will tend to be the most volatile.

Fluctuations in the balance of supply and demand set up a classic boom–bust cycle in real estate. First, the boom: Perceptions of rising demand, property values, lease rates, and occupancy induce development of new properties. This investment spending helps drive and/or sustain economic activity, which, in turn, reinforces the perceived profitability of building new capacity. Then, the bust: Inevitably, optimistic projections lead to overbuilding and declining property values, lease rates, and occupancy. Since property has a very long life and is immobile, leases are typically for multiple years and staggered across tenants. In addition, since moving is costly for tenants, it may take many months or years for the excess supply to be absorbed.

A study by Clayton, Fabozzi, Gilberto, Gordon, Hudson-Wilson, Hughes, Liang, MacKinnon, and Mansour (2011) suggested that the US commercial real estate crash following the global financial crisis was the first to have been driven by the capital markets rather than by a boom–bust cycle in real estate fundamentals.¹⁸ The catalyst was not overbuilding, Clayton et al. argued, but rather excess leverage and investment in more speculative types of properties. Consistent with that hypothesis, both the collapse in property prices and the subsequent recovery were unusually rapid. The authors attributed the accelerated response to underlying conditions to appraisers responding more vigorously to signals from the REIT and commercial mortgage-backed security markets. It remains to be seen whether this phenomenon will persist in less extreme circumstances.

5.3 Capitalization Rates

The capitalization (cap) rate, defined as net operating income (NOI) in the current period divided by the property value, is the standard valuation metric for commercial real estate. It is analogous to the earnings yield (E/P) for equities. It is not, strictly speaking, a cash flow yield because a portion of operating income may be reinvested in the property.¹⁹ As with equities, an estimate of the long-run expected/required rate of return can be derived from this ratio by assuming a constant growth rate for NOI—that is, by applying the Gordon growth model.

$$E(R_{re}) = \text{Cap rate} + \text{NOI growth rate.} \quad (7)$$

The long-run, steady-state NOI growth rate for commercial real estate as a whole should be reasonably close to the growth rate of GDP. The observation that over a 30-year period UK nominal rental income grew about 6.5% per annum, roughly 2.5% in real terms,²⁰ is consistent with this relationship.

Over finite horizons, it is appropriate to adjust this equation to reflect the anticipated rate of change in the cap rate.

$$E(R_{re}) = \text{Cap rate} + \text{NOI growth rate} - \% \Delta \text{Cap rate.} \quad (8)$$

¹⁸ Data from the Investment Property Databank indicate that commercial property values dropped by 21.8% globally and US property values decreased by 33.2% in 2008–2009. Other countries suffered steep losses as well, notably Ireland (55.5%) and Spain (20.1%).

¹⁹ Ilmanen (2012) indicated that the difference between cap rates and cash flow yields may be on the order of 3 percentage points. Although significant reinvestment of NOI reduces the cash flow yield, it should increase the growth rate of NOI if the investment is productive.

²⁰ Based on data from Investment Property Databank Limited.

This equation is analogous to the Grinold–Kroner model for equities, except there is no term for share buybacks. The growth rate of NOI could, of course, be split into a real component and inflation.

Exhibit 6 shows private market cap rates as of March 2018 for US commercial properties differentiated by type, location, and quality. The rates range from 4.7% for offices in gateway cities, such as New York City, to 9.5% for skilled nursing (i.e., 24-hour old-age care) properties. There is a clear pattern of high cap rates for riskier property types (hotels versus apartments, skilled nursing facilities versus medical offices), lower-quality properties (low-productivity versus high-productivity malls), and less attractive locations (offices in secondary versus gateway cities).

Exhibit 6 Cap Rates (%) as of March 2018

Property Type	Average	Higher Risk	Lower Risk
Hotels	7.2	Limited Service 7.7	Full Service 7.1
Health Care	6.6	Skilled Nursing 9.5	Medical Office 5.7
Retail Malls	5.6	Low Productivity 8.8	High Productivity 5.0
Industrial	5.4		
Office	5.2	Secondary Cities 6.6	Gateway Cities 4.7
Apartments	4.8		

Source: CenterSquare Investment Management (2018). Gateway cities include Boston, Chicago, Los Angeles, New York City, San Francisco, and Washington, DC.

Retail properties provide a good example of the impact of competition on real estate. Brick-and-mortar stores have been under increasing competitive pressure from online retailers, such as Amazon. The pressure is especially intense for lower-productivity (less profitable) locations. As a result, cap rates for high- and low-productivity malls began to diverge even before the global financial crisis. In 2006, the difference in cap rates was 1.2 percentage points; by 2018, it was 3.2 percentage points.²¹

Cap rates reflect long-term discount rates. As such, we should expect them to rise and fall with the general level of long-term interest rates, which tends to make them pro-cyclical. However, they are also sensitive to credit spreads and the availability of credit. Peyton (2009) found that the spread between cap rates and the 10-year Treasury yield is positively related to the option-adjusted spread on three- to five-year B-rated corporate bonds and negatively related to ratios of household and non-financial-sector debt to GDP. The countercyclical nature of credit spreads mitigates the cyclicity of cap rates. The debt ratios are effectively proxies for the availability of debt financing for leveraged investment in real estate. Since real estate transactions typically involve substantial leverage, greater availability of debt financing is likely to translate into a lower required liquidity premium component of expected real estate returns. Not surprisingly, higher vacancy rates induce higher cap rates.

²¹ CenterSquare Investment Management (2018). These are cap rates implied by REIT pricing, which is why the 2018 differential does not exactly match the private market figures given in Exhibit 6.

5.4 The Risk Premium Perspective on Real Estate Expected Return

As a very long-lived asset, real estate is quite sensitive to the level of long-term rates; that is, it has a high effective duration. Indeed, this is often the one and only characteristic mentioned in broad assessments of the likely performance of real estate as an asset class. Hence, real estate must earn a significant term premium. Income-earning properties are exposed to the credit risk of the tenants. In essence, a fixed-term lease with a stable stream of payments is like a corporate bond issued by the tenant secured with physical assets. The landlord must, therefore, demand a credit premium commensurate with what his or her average tenant would have to pay to issue such debt. Real estate must also earn a significant equity risk premium (relative to corporate debt) since the owner bears the full brunt of fluctuations in property values as well as uncertainty with respect to rent growth, lease rollover/termination, and vacancies. The most volatile component of return arises, of course, from changes in property values. As noted previously, these values are strongly pro-cyclical, which implies the need for a significant equity risk premium. Combining the bond-like components (term premium plus credit premium) with a stock-like component implies a risk premium somewhere between those of corporate bonds and equities.

Liquidity is an especially important risk for direct real estate ownership. There are two main ways to view illiquidity. For publicly traded equities and bonds, the question is not whether one can sell the security quickly but, rather, at what price. For real estate, however, it may be better to think of illiquidity as a total inability to sell the asset except at randomly spaced points in time. From this perspective, the degree of liquidity depends on the average frequency of these trading opportunities. By adopting this perspective, one can ask how large the liquidity premium must be to induce investors to hold an asset with a given level of liquidity. Ang, Papanikolaou, and Westerfield (2014) analyzed this question. Their results suggest liquidity premiums on the order of 0.60% for quarterly average liquidity, 0.90% for annual liquidity, and 2%, 4%, and 6% for liquidity on average every 2, 5, and 10 years, respectively.²² All things considered, a liquidity premium of 2%–4% would seem reasonable for commercial real estate.

5.5 Real Estate in Equilibrium

Real estate can be incorporated into an equilibrium framework (such as the Singer–Terhaar model). Indeed, doing so might be deemed a necessity given the importance of real estate in global wealth. There are, however, a few important considerations. First, the impact of smoothing must have been removed from the risk/return data and metrics used for real estate. Otherwise, inclusion of real estate will distort the results for all asset classes. Second, it is important to recognize the implicit assumption of fully liquid assets in equilibrium models. Adjusting the equilibrium for illiquidity—that is, adding a liquidity premium—is especially important for real estate and other private assets. Third, although real estate investors increasingly venture outside their home markets, real estate is still location specific and may, therefore, be more closely related to local, as opposed to global, economic/market factors than are financial claims.

²² See Table 3 in Ang et al. (2014). The numbers cited here reflect an assumption of zero correlation between the investor's liquid and illiquid assets.

5.6 Public vs. Private Real Estate

Many institutional investors and some ultra-wealthy individuals are able to assemble diversified portfolios of direct real estate holdings. Investors with smaller portfolios must typically choose between limited, undiversified direct real estate holdings or obtaining real estate exposure through financial instruments, such as REIT shares. Assessing whether these alternatives—direct real estate and REITs—have similar investment characteristics is difficult because of return smoothing, heterogeneity of properties, and variations in leverage.

A careful analysis of this issue requires (1) transaction-based returns for unlevered direct real estate holdings, (2) firm-by-firm deleveraging of REIT returns based on their individual balance sheets over time, and (3) carefully constructing direct real estate and REIT portfolios with matching property characteristics. Exhibit 7 shows the results of such an analysis.

Exhibit 7 Direct Real Estate vs. REITs: Four Property Types, 1994–2012

	Mean Return (%)			Standard Deviation (%)		
	Direct Real Estate	REITs		Direct Real Estate	REITs	
		Unlevered	Levered		Unlevered	Levered
Aggregate	8.80	9.29		11.09	9.71	
Apartment	9.49	9.08	11.77	11.42	9.50	20.69
Office	8.43	9.37	10.49	10.97	10.58	23.78
Industrial	9.00	9.02	9.57	11.14	11.65	23.46
Retail	8.96	9.90	12.04	11.54	10.03	23.73

Source: Ling and Naranjo (2015, Table 1).

Deleveraging the REITs substantially reduces both their mean returns and their volatilities. The volatilities are roughly cut in half. Clearly, the unleveraged REIT returns are much more similar to the direct real estate returns than are the levered REIT returns. In the aggregate, REITs outperformed direct real estate by 49 bps per year with lower volatility. Looking at specific property types, REITs had higher returns and lower volatility in two categories—office and retail. Industrial REITs had essentially the same return as directly owned industrial properties but with higher volatility. Apartment REITs lagged the direct market but with significantly lower volatility.

Exhibit 7 certainly shows some interesting differences. The pattern of unlevered REIT returns by property type is not the same as for direct real estate. Retail REITs had the highest return, and industrial REITs had the lowest. Among directly owned properties, apartments had the highest return and offices the lowest. A similar mismatch appears with respect to volatilities.

Overall, this study tends to support the general conclusion reached by most comparisons: Public and private commercial real estate are different. The extent of the difference is less clear. It does appear that once we account for differences in leverage, REIT investors are not sacrificing performance to obtain the liquidity afforded by publicly traded shares. Perhaps REIT investors are able to capture a significant portion of the liquidity risk premium garnered by direct investors (because the REIT is a direct investor) as well as benefit from professional management.

What about the diversification benefits of real estate as an asset class? REITs are traded securities, and that fact shows up in their much higher short-term correlation with equities. In contrast, direct real estate is often touted as a good diversifier based

on the notion that it is not very highly correlated with equities. As noted previously, the smoothed nature of most published real estate returns is a major contributor to the appearance of low correlation with financial assets, including with REITs. Once that is corrected, however, the correlation is higher, even over reasonably short horizons, such as a quarter or a year. Importantly, REITs are more highly correlated with direct real estate and less highly correlated with equities over multi-year horizons.²³ Thus, although REITs tend to act like “stocks” in the short run, they act like “real estate” in the longer run. From a strategic asset allocation perspective, REITs and direct real estate are more comparable than conventional metrics suggest.

5.7 Long-Term Housing Returns

Savills World Research (2016) estimated that residential real estate accounts for 75% of the total value of developed properties globally. Most individuals’ homes are their primary, perhaps only, real estate investment. A relatively new database provides a global perspective on the long-term performance of residential real estate (housing), equities, and bonds.²⁴ The database covers 145 years (1870–2015) and 16 countries.

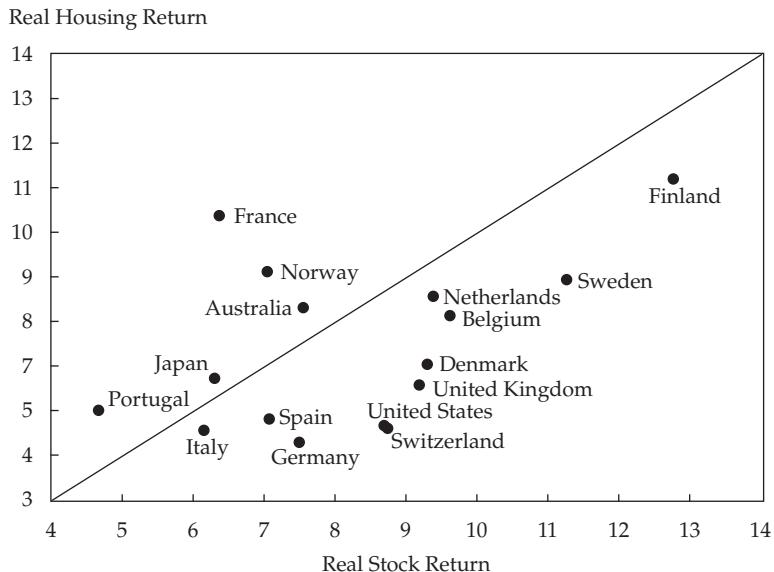
Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2017) found that residential real estate was the best performing asset class over the entire sample period, with a higher real return and much lower volatility than equities. However, performance characteristics differed before and after World War II:

- Residential real estate had a higher (lower) real return than equities before (after) World War II.
- Residential real estate had a higher real return than equities in every country except Switzerland, the United Kingdom, and the United States over 1950–1980 but a lower return than equities in every country for 1980–2015.
- Residential real estate and equities had similar patterns—that is, a strong correlation—prior to the war but a low correlation after the war.
- Equity returns became increasingly correlated across countries after the war, but residential real estate returns are essentially uncorrelated across countries.

Exhibit 8 shows the real returns for equities and residential real estate in each country since 1950.

²³ Stefek and Suryanarayanan (2012).

²⁴ The database was developed for and is described in Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2017).

Exhibit 8 Real Equity and Housing Returns by Country, 1950–2015

Note: Annual percentage returns are shown.

Source: Jordà et al. (2017).

EXAMPLE 7**Assessing Real Estate Investments**

Tammi Sinclair, an analyst at a large retirement fund, recently attended investor presentations by three private real estate firms looking to fund new projects. Office Growth Partners specializes in building and owning low-cost, standardized office space for firms seeking to place sales representatives in the most rapidly growing small population areas across the region. Mega-Box Properties builds and owns large, custom-designed distribution facilities for multinational makers of brand-name products. The facilities are strategically located near major global transportation hubs. Exclusive Elegance Inc. develops and then manages some of the world's most luxurious, sought-after residential buildings in prime locations. It never breaks ground on a new property until at least 85% of the units have been sold and, to date, has never failed to sell out before construction is complete.

Identify important characteristics of each business that Sinclair will need to consider in establishing a required rate of return for each potential investment.

Guideline answer:

Office Growth Partners (OGP) is likely to be a very high-risk investment. It essentially chases hot markets, it builds generic office space, and its typical tenants (opportunistic sales forces) are apt to opt out as soon as the market cools. All these aspects suggest that its business is very exposed to a boom-and-bust cycle. It is likely to end up owning properties with persistently high vacancy rates and high turnover. Hence, Sinclair will likely require a rather high expected return on an investment in OGP.

Mega-Box's business should be fairly stable. The distribution centers are strategically located and designed to meet the needs of the tenant, which suggests long-term leases and low turnover will benefit both Mega-Box and the tenant

firms. The average credit quality of the tenants—multinational makers of brand-name products—is likely to be solid and disciplined by the public bond and loan markets. All things considered, Sinclair should probably require a significantly lower expected return on an investment in Mega-Box than in OGP.

Exclusive Elegance appears to be even lower risk. First, it deals only in the very highest-quality, most sought-after properties in prime locations. These should be relatively immune to cyclical fluctuations. Second, it does not retain ownership of the properties, so it does not bear the equity/ownership risks. Third, it is fairly conservative in the riskiest portion of its business—developing new properties. However, Sinclair will need to investigate its record with respect to completing development projects within budget, maintaining properties, and delivering top-quality service to residents.

FORECASTING EXCHANGE RATES

6

Forecasting exchange rates is generally acknowledged to be especially difficult—so difficult that many asset managers either passively accept the impact of currency movements on their portfolio returns or routinely hedge out the currency exposure even if doing so is costly.

To get a sense for why exchange rates are so difficult to forecast, it is useful to distinguish between “money” and the currency in which it is denominated. Like equities and bonds, money is an asset denominated in a currency. Currencies are the units of account in which the prices of everything else—goods, services, real assets, financial assets, liabilities, flows, and balances—are quoted. An exchange rate movement changes the values of everything denominated in one currency relative to everything denominated in every other currency. That is a very powerful force. It works in the other direction as well. Anything that affects quantities, prices, or values within one currency relative to those in another will exert some degree of pressure on exchange rates. Perhaps even more importantly, anything that changes *expectations* of prices, quantities, or values within any currency can change expectations about the future path of currencies, causing an immediate reaction in exchange rates as people adjust their exposures.

Of course, currencies are not abstract accounting ledgers. They are inherently tied to governments, financial systems, legal systems, and geographies. The laws, regulations, customs, and conventions within and between these systems also influence exchange rates, especially when exchange rates are used as instruments or targets of policy. The consequence of all these aspects is that there is very little firm ground on which to stand for analysts trying to forecast exchange rates. The best we can hope to do is to identify the forces that are likely to be exerting the most powerful influences and assess their relative strength. On a related note, it is not possible to identify mutually exclusive approaches to exchange rate forecasting that are each complete enough to stand alone. Hence, the perspectives discussed in this section should be viewed as complementary rather than as alternatives.

6.1 Focus on Goods and Services, Trade, and the Current Account

There are three primary ways in which trade in goods and services can influence the exchange rate. The first is directly through flows. The second is through quasi-arbitrage of prices. The third is through competitiveness and sustainability.

6.1.1 Trade Flows

Trade flows do not, in general, exert a significant impact on contemporaneous exchange rate movements, provided they can be financed. Although gross trade flows may be large, net flows (exports minus imports) are typically much smaller relative to the economy and relative to actual and potential financial flows. If trade-related flows through the foreign exchange market become large relative to financing/investment flows, it is likely that a crisis is emerging.

6.1.2 Purchasing Power Parity

Purchasing power parity (PPP) is based on the notion that the prices of goods and services should change at the same rate regardless of currency denomination.²⁵ Thus, *the expected percentage change in the exchange rate should be equal to the difference in expected inflation rates*. If we define the *real exchange rate* as the ratio of price levels converted to a common currency, then PPP says that *the expected change in the real exchange rate should be zero*.

The mechanism underlying PPP is a quasi-arbitrage. Free and competitive trade should force alignment of the prices of similar products after conversion to a common currency. This is a very powerful force. It works, but it is slow and incomplete. As a result, the evidence indicates that PPP is a poor predictor of exchange rates over short to intermediate horizons but is a better guide to currency movements over progressively longer multi-year horizons.²⁶

There are numerous reasons for deviations from PPP. The starting point matters. Relative PPP implicitly assumes that prices and exchange rates are already well aligned. If not, it will take time before the PPP relationship re-emerges. Not all goods are traded, and virtually every country imposes some trade barriers. PPP completely ignores the impact of capital flows, which often exert much more acute pressure on exchange rates over significant periods of time. Finally, economic developments may necessitate changes in the country's terms of trade; that is, contrary to PPP, the real exchange rate may need to change over time.

The impact of relative purchasing power on exchange rates tends to be most evident when inflation differentials are large, persistent, and driven primarily by monetary conditions. Under these conditions, PPP may describe exchange rate movements reasonably well over all but the shortest horizons. Indeed, the well-known "monetary approach" to exchange rates essentially boils down to two assumptions: (1) PPP holds, and (2) inflation is determined by the money supply.

6.1.3 Competitiveness and Sustainability of the Current Account

It is axiomatic that in the absence of capital flows prices, quantities, and exchange rates would have to adjust so that trade is always balanced. Since the prices of goods and services, production levels, and spending decisions tend to adjust only gradually, the onus of adjustment would fall primarily on exchange rates. Allowing for capital flows mitigates this pressure on exchange rates. The fact remains, however, that imposition of restrictions on capital flows will increase the sensitivity of exchange rates to the

²⁵ This version of PPP is usually referred to as "relative PPP" to distinguish it from a stricter notion called "absolute PPP." Absolute PPP is an important concept but is not useful for practical forecasting. See previous CFA Program currency readings for a broader discussion of PPP concepts.

²⁶ See, for example, Abuaf and Jorion (1990); Exhibit 2 in "Currency Exchange Rates: Understanding Equilibrium Value" provides a useful visual illustration of PPP over different horizons.

trade balance or, more generally, the current account balance.²⁷ This is not usually a major consideration for large, developed economies with sophisticated financial markets but can be important in small or developing economies.

Aside from the issue of restrictions on capital mobility, the extent to which the current account balance influences the exchange rate depends primarily on whether it is likely to be persistent and, if so, whether it can be sustained. These issues, in turn, depend mainly on the size of the imbalance and its source. Small current account balances—say, less than 2% of GDP—are likely to be sustainable for many years and hence would exert little influence on exchange rates. Similarly, larger imbalances that are expected to be transitory may not generate a significant, lasting impact on currencies.

The current account balance equals the difference between national saving and investment.²⁸ A current account surplus indicates that household saving plus business profits and the government surplus/deficit exceeds domestic investment spending. A current account deficit reflects the opposite. A current account deficit that reflects strong, profitable investment spending is more likely to be sustainable than a deficit reflecting high household spending (low saving), low business profits, or substantial government deficits because it is likely to attract the required capital inflow for as long as attractive investment opportunities persist. A large current account surplus may not be very sustainable either because it poses a sustainability problem for deficit countries or because the surplus country becomes unwilling to maintain such a high level of aggregate saving.

Whether an imbalance is likely to persist in the absence of terms-of-trade adjustments largely depends on whether the imbalance is structural. Structural imbalances arise from (1) persistent fiscal imbalances; (2) preferences, demographics, and institutional characteristics affecting saving decisions; (3) abundance or lack of important resources; (4) availability/absence of profitable investment opportunities associated with growth, capital deepening, and innovation; and, of course, (5) the prevailing terms of trade. Temporary imbalances mainly arise from business cycles (at home and abroad) and associated policy actions.

If a change in the (nominal) exchange rate is to bring about a necessary change in the current account balance, it will have to induce changes in spending patterns, consumption/saving decisions, and production/investment decisions. These adjustments typically occur slowly and are often resisted by decision makers who hope they can be avoided. Rapid adjustment of the exchange rate may also be resisted because people only gradually adjust their expectations of its ultimate level. Hence, both the exchange rate and current account adjustments are likely to be gradual.

6.2 Focus on Capital Flows

Since the current account and the capital account must always balance and the drivers of the current account tend to adjust only gradually, virtually all of the short-term adjustment and much of the intermediate-term adjustment must occur in the capital account. Asset prices, interest rates, and exchange rates are all part of the equilibrating mechanism. Since a change in the exchange rate simultaneously affects the relative values of all assets denominated in different currencies, we should expect significant pressure to be exerted on the exchange rate whenever an adjustment of capital flows is required.

²⁷ The Mundell–Fleming model of monetary and fiscal policy effects on the exchange rate with high/low capital mobility provides an important illustration of this point. See the CFA Program reading “Currency Exchange Rates: Understanding Equilibrium Value.”

²⁸ See Chapter 4 of Piros and Pinto (2013) for discussion of balance of payments accounting.

6.2.1 Implications of Capital Mobility

Capital seeks the highest risk-adjusted expected return. The investments available in each currency can be viewed as a portfolio. Designating one as domestic (d) and one as foreign (f), in a world of perfect capital mobility the exchange rate (expressed as domestic currency per foreign currency unit) will be driven to the point at which the expected percentage change in the exchange rate equals the “excess” risk-adjusted expected return on the domestic portfolio over the foreign portfolio. This idea can be expressed concretely using a building block approach to expected returns.

$$E(\% \Delta S_{d/f}) = (r^d - r^f) + (\text{Term}^d - \text{Term}^f) + (\text{Credit}^d - \text{Credit}^f) + (\text{Equity}^d - \text{Equity}^f) + (\text{Liquid}^d - \text{Liquid}^f). \quad (9)$$

The expected change in the exchange rate ($\% \Delta S_{d/f}$) will reflect the differences in the nominal short-term interest rates (r), term premiums (Term), credit premiums (Credit), equity premiums (Equity), and liquidity premiums (Liquid) in the two markets. The components of this equation can be associated with the expected return on various segments of the portfolio: the money market (first term), government bonds (first and second), corporate bonds (first–third), publicly traded equities (first–fourth), and private assets (all terms), including direct investment in plant and equipment.

As an example, suppose the domestic market has a 1% higher short-term rate, a 0.25% lower term premium, a 0.50% higher credit premium, and the same equity and liquidity premiums as the foreign market. Equation 9 implies that the domestic currency must be expected to depreciate by 1.25% ($= 1\% - 0.25\% + 0.5\%$)—that is, $E(\% \Delta S_{d/f}) = 1.25\%$ —to equalize risk-adjusted expected returns.

It may seem counterintuitive that the domestic currency should be expected to depreciate if its portfolio offers a higher risk-adjusted expected return. The puzzle is resolved by the key phrase “driven to the point . . .” in this subsection’s opening paragraph. In theory, the exchange rate will instantly move (“jump”) to a level where the currency with higher (lower) risk-adjusted expected return will be so strong (weak) that it will be expected to depreciate (appreciate) going forward. This is known as the *overshooting* mechanism, introduced by Dornbusch (1976). In reality, the move will not be instantaneous, but it may occur very quickly if there is a consensus about the relative attractiveness of assets denominated in each currency. Of course, asset prices will also be adjusting.

The overshooting mechanism suggests that there are likely to be three phases in response to relative improvement in investment opportunities. First, the exchange rate will appreciate ($S_{d/f}$ will decline) as capital flows toward the more attractive market. The more vigorous the flow, the faster and greater the appreciation of the domestic currency and the more the flow will also drive up asset prices in that market. Second, in the intermediate term, there will be a period of consolidation as investors begin to question the extended level of the exchange rate and to form expectations of a reversal. Third, in the longer run, there will be a retracement of some or all of the exchange rate move depending on the extent to which underlying opportunities have been equalized by asset price adjustments. This is the phase that is reflected in Equation 9.

Importantly, these three phases imply that the relationship between currency appreciation/depreciation and apparent investment incentives will not always be in the same direction. This fact is especially important with respect to interest rate differentials since they are directly observable. At some times, higher-interest rate currencies appreciate; at other times, they depreciate.

6.2.2 Uncovered Interest Rate Parity and Hot Money Flows

Uncovered interest rate parity (UIP) asserts that the expected percentage change in the exchange rate should be equal to the nominal interest rate differential. That is, only the first term in Equation 9 matters. The implicit assumption is that the response to short-term interest rate differentials will be so strong that it overwhelms all other considerations.

Contrary to UIP, the empirical evidence consistently shows that *carry trades*—borrowing in low-rate currencies and lending in high-rate currencies—earn meaningful profits on average. For example, Burnside, Eichenbaum, Kleshchelski, and Rebelo (2011) found that from February 1976 to July 2009, a strategy of rolling carry trades involving portfolios of high- and low-rate currencies returned 4.31% per annum after transaction costs versus the US dollar and 2.88% per annum versus the British pound.

The profitability of carry trades is usually ascribed to a risk premium, which is clearly consistent with the idea that the risk premiums in Equation 9 matter. The empirical results may also be capturing primarily the overshooting phase of the response to interest rate differentials. In any case, carry trades tend to be profitable on average, and UIP does not hold up well as a predictor of exchange rates.

Vigorous flows of capital in response to interest rate differentials are often referred to as *hot money flows*. Hot money flows are problematic for central banks. First, they limit the central bank's ability to run an effective monetary policy. This is the key message of the Mundell–Fleming model with respect to monetary policy in economies characterized by the free flow of capital. Second, a flood of readily available short-term financing may encourage firms to fund longer-term needs with short-term money, setting the stage for a crisis when the financing dries up. Third, the nearly inevitable overshooting of the exchange rate is likely to disrupt non-financial businesses. These issues are generally most acute for emerging markets since their economies and financial markets tend to be more fragile. Central banks often try to combat hot money flows by intervening in the currency market to offset the exchange rate impact of the flows. They may also attempt to *sterilize* the impact on domestic liquidity by selling government securities to limit the growth of bank reserves or maintain a target level of interest rates. If the hot money is flowing *out* rather than *in*, the central bank would do the opposite: sell foreign currency (thereby draining domestic liquidity) to limit/avoid depreciation of the domestic currency and buy government securities (thereby providing liquidity) to sterilize the impact on bank reserves and interest rates. In either case, if intervention is not effective or sufficient, capital controls may be imposed.

6.2.3 Portfolio Balance, Portfolio Composition, and Sustainability Issues

The earlier discussion on the implications of capital mobility implicitly introduced a portfolio balance perspective. Each country/currency has a unique portfolio of assets that makes up part of the global “market portfolio.” Exchange rates provide an across-the-board mechanism for adjusting the relative sizes of these portfolios to match investors’ desire to hold them. We will look at this from three angles: tactical allocations, strategic/secular allocations, and the implications of wealth transfer.

The relative sizes of different currency portfolios within the global market portfolio do not, in general, change significantly over short to intermediate horizons. Hence, investors do not need to be induced to make changes in their long-term allocations. However, they are likely to want to make tactical allocation changes in response to evolving opportunities—notably, those related to the relative strength of various economies and related policy measures. Overall, capital is likely to flow into the currencies of countries in the strongest phases of the business cycle. The attraction should be especially strong if the economic expansion is led by robust investment in real, productive assets (e.g., plant and equipment) since that can be expected to generate a new stream of long-run profits.

In the long run, the relative size of each currency portfolio depends primarily on relative trend growth rates and current account balances. Rapid economic growth is almost certain to be accompanied by an expanding share of the global market portfolio being denominated in the associated currency. Thus, investors will have to be induced to increase their strategic allocations to assets in that country/currency. All else the same, this would tend to weaken that currency—partially offsetting the increase in the currency's share of the global portfolio—and upward pressure on risk premiums in that market. However, there are several mitigating factors.

- *With growth comes wealth accumulation:* The share of global wealth owned by domestic investors will be rising along with the supply of assets denominated in their currency. Since investors generally exhibit a strong *home country bias* for domestic assets, domestic investors are likely to willingly absorb a large portion of the newly created assets.
- *Productivity-driven growth:* If high growth reflects strong productivity gains, both foreign and domestic investors are likely to willingly fund it with both financial flows and foreign direct investment.
- *Small initial weight in global portfolios:* Countries with exceptionally high trend growth rates are typically relatively small, have previously restricted foreign access to their local-currency financial markets, and/or have previously funded external deficits in major currencies (not their own). Almost by definition, these are emerging and frontier markets. Any of these factors would suggest greater capacity to increase the share of local-currency-denominated assets in global portfolios without undermining the currency.

Large, persistent current account deficits funded in local currency will also put downward pressure on the exchange rate over time as investors are required to shift strategic allocations toward that currency. Again, there are mitigating considerations.

- *The source of the deficit matters:* As discussed previously, current account deficits arising from strong investment spending are relatively easy to finance as long as they are expected to be sufficiently profitable. Deficits due to a low saving rate or weak fiscal discipline are much more problematic.
- *Special status of reserve currencies:* A few currencies—notably, the US dollar—have a special status because the bulk of official reserves are held in these currencies, the associated sovereign debt issuer is viewed as a safe haven, major commodities (e.g., oil) are priced in these currencies, and international trade transactions are often settled in them. A small current account deficit in a reserve-currency country is welcome because it helps provide liquidity to the global financial system. Historically, however, reserve currency status has not proven to be permanent.

Current account surpluses/deficits reflect a transfer of wealth from the deficit country to the surplus country. In an ideal world of fully integrated markets, perfect capital mobility, homogeneous expectations, and identical preferences,²⁹ a transfer of wealth would have virtually no impact on asset prices or exchange rates because everyone would be happy with the same portfolio composition. This is not the case in practice. To pick just one example, as long as investors have a home country bias, the transfer of wealth will increase the demand for the current-account-surplus country's assets and currency and decrease demand for those of the deficit country.

Does the composition of a particular currency's portfolio matter? A look back at Equation 9 suggests that it should matter to some degree. For the most part, however, we would expect asset price adjustments (changes in interest rates and risk premiums)

²⁹ Note that these are essentially the assumptions underlying the standard CAPM.

to eliminate most of the pressure that might otherwise be exerted on the exchange rate. Nonetheless, some types of flows and holdings are often considered to be more or less supportive of the currency. Foreign direct investment flows are generally considered to be the most favorable because they indicate a long-term commitment and they contribute directly to the productivity/profitability of the economy. Similarly, investments in private real estate and private equity represent long-term capital committed to the market, although they may or may not represent the creation of new real assets. Public equity would likely be considered the next most supportive of the currency. Although it is less permanent than private investments, it is still a residual claim on the profitability of the economy that does not have to be repaid. Debt has to be serviced and must either be repaid or refinanced, potentially triggering a crisis. Hence, a high and rising ratio of debt to GDP gives rise to *debt sustainability* concerns with respect to the economy. This issue could apply to private sector debt. But it is usually associated with fiscal deficits because the government is typically the largest single borrower; typically borrows to fund consumption and transfers, rather than productive investment; and may be borrowing in excess of what can be serviced without a significant increase in taxes. Finally, as noted previously with respect to hot money flows, large or rapid accumulation of short-term borrowing is usually viewed as a clear warning sign for the currency.

EXAMPLE 8**Currency Forecasts**

After many years of running moderately high current account deficits (2%–4% of GDP) but doing little infrastructure investment, Atlandia plans to increase the yearly government deficit by 3% of GDP and maintain that level of deficit for the next 20 years, devoting the increase to infrastructure spending. The deficits will be financed with local-currency government debt. Pete Stevens, CFA, is faced with the task of assessing the impact of this announcement on the Atlandian currency. After talking with members of the economics department at his firm, he has established the following baseline assumptions:

- All else the same, current account deficits will persistently exceed 6% of GDP while the program is in place. Setting aside any lasting impact of the policy/spending, the current account deficit will then fall back to 3% of GDP provided the economy has remained competitive.
- Pressure on wages will boost inflation to 1.5% above the global inflation rate. Because of limitations on factor substitutability, costs in the traded good sector will rise disproportionately.
- Expectations of faster growth will raise the equity premium.
- The central bank will likely tighten policy—that is, raise rates.

Questions:

- 1 What would purchasing power parity imply about the exchange rate?
- 2 What are the implications for competitiveness for the currency?
- 3 What is the likely short-term impact of capital flows on the exchange rate?
- 4 What does the overshooting mechanism imply about the path of the exchange rate over time? How does this fit with the answers to Questions 1–3?
- 5 What does a sustainability perspective imply?

Solutions:

- 1 Purchasing power parity would imply that the Atlandian currency will depreciate by 1.5% per year. The exchange rate, quoted in domestic (Atlandian) units per foreign unit as in Equation 9, will rise by a factor of $1.015^{10} = 1.1605$, corresponding to a 13.83% ($= 1 - 1/1.1605$) decline in the value of the domestic currency.³⁰
- 2 Since costs in the traded sector will rise faster than inflation, the exchange rate would need to depreciate faster than PPP implies in order to maintain competitiveness. Thus, to remain competitive and re-establish a 3% current account deficit after 10 years, the *real* exchange rate needs to depreciate.
- 3 Both the increase in short-term rates and the increase in the equity premium are likely to induce strong short-term capital inflows even before the current account deficit actually increases. This should put significant pressure on the Atlandian currency to appreciate (i.e., the $S_{d/f}$ exchange rate will decline if the Atlandian currency is defined as the domestic currency). The initial impact may be offset to some extent by flows out of government bonds as investors push yields up in anticipation of increasing supply, but as bonds are repriced to offer a higher expected return (a higher term premium), it will reinforce the upward pressure on the exchange rate.
- 4 The overshooting mechanism would imply that the initial appreciation of the Atlandian currency discussed previously will extend to a level from which the currency is then expected to depreciate at a pace that equalizes risk-adjusted expected returns across markets and maintains equality between the current and capital accounts. The initial appreciation of the currency in this scenario is clearly inconsistent with PPP, but the subsequent longer-term depreciation phase (from a stronger level) is likely to bring the exchange rate into reasonable alignment with PPP and competitiveness considerations in the long run.
- 5 It is highly unlikely that a current account deficit in excess of 6% of GDP is sustainable for 10 years. It would entail an increase in net foreign liabilities equaling 60% ($= 6\% \times 10$) of GDP. Servicing that additional obligation would add, say, 2%–3% of GDP to the current account deficit forever. Adding that to the baseline projection of 3% would mean that the current account deficit would remain in the 5%–6% range even after the infrastructure spending ended, so net foreign liabilities would still be accumulating rapidly. Closing that gap will require a very large increase in net national saving: 5%–6% of annual GDP *in addition* to the 3% reduction in infrastructure spending when the program ends. Standard macroeconomic analysis implies that such an adjustment would require some combination of a very deep recession and a very large depreciation in the real value of the Atlandian currency (i.e., the real $S_{d/f}$ exchange rate must increase sharply). As soon as investors recognize this, a crisis is almost certain to occur. Bond yields would increase sharply, and equity prices and the currency will fall substantially.

³⁰ Note that a slightly different number is obtained if the 1.5% rate is applied directly to the foreign currency value of the Atlandian currency (i.e., the exchange rate expressed as foreign units per domestic unit). That calculation would give a cumulative depreciation of 14.03% ($= 1 - 0.985^{10}$). The difference arises because $(1/1.015)$ is not exactly equal to 0.985.

FORECASTING VOLATILITY

7

In some applications, the analyst is concerned with forecasting the variance for only a single asset. More often, however, the analyst needs to forecast the variance–covariance matrix for several, perhaps many, assets in order to analyze the risk of portfolios. Estimating a single variance that is believed to be constant is straightforward: The familiar sample variance is unbiased and its precision can be enhanced by using higher-frequency data. The analyst's task becomes more complicated if the variance is not believed to be constant or the analyst needs to forecast a variance–covariance (VCV) matrix. These issues are addressed in this section. In addition, we elaborate on de-smoothing real estate and other returns.

7.1 Estimating a Constant VCV Matrix with Sample Statistics

The simplest and most heavily used method for estimating constant variances and covariances is to use the corresponding sample statistic—variance or covariance—computed from historical return data. These elements are then assembled into a VCV matrix. There are two main problems with this method, both related to sample size. First, given the short to intermediate sample periods typical in finance, the method cannot be used to estimate the VCV matrix for large numbers of assets. If the number of assets exceeds the number of historical observations, then some portfolios will erroneously appear to be riskless. Second, given typical sample sizes, this method is subject to substantial sampling error. A useful rule of thumb that addresses both of these issues is that the number of observations should be at least 10 times the number of assets in order for the sample VCV matrix to be deemed reliable. In addition, since each element is estimated without regard to any of the others, this method does not address the issue of imposing cross-sectional consistency.

7.2 VCV Matrices from Multi-Factor Models

Factor models have become the standard method of imposing structure on the VCV matrix of asset returns. From this perspective, their main advantage is that the number of assets can be very large relative to the number of observations. The key to making this work is that the covariances are fully determined by exposures to a small number of common factors whereas each variance includes an asset-specific component.

In a model with K common factors, the return on the i th asset is given by

$$r_i = \alpha_i + \sum_{k=1}^K \beta_{ik} F_k + \varepsilon_i \quad (10)$$

where α_i is a constant intercept, β_{ik} is the asset's sensitivity to the k th factor, F_k is the k th common factor return, and ε_i is a stochastic term with a mean of zero that is unique to the i th asset. In general, the factors will be correlated. Given the model, the variance of the i th asset is

$$\sigma_i^2 = \sum_{m=1}^K \sum_{n=1}^K \beta_{im} \beta_{in} \rho_{mn} + v_i^2 \quad (11)$$

where ρ_{mn} is the covariance between the m th and n th factors and v_i^2 is the variance of the unique component of the i th asset's return. The covariance between the i th and j th assets is

$$\sigma_{ij} = \sum_{m=1}^K \sum_{n=1}^K \beta_{im} \beta_{jn} \rho_{mn} \quad (12)$$

As long as none of the factors are redundant and none of the asset returns are completely determined by the factors (so $v_i^2 \neq 0$), there will not be any portfolios that erroneously appear to be riskless. That is, we will not encounter the first problem mentioned in Section 7.1, with respect to using sample statistics.

Imposing structure with a factor model makes the VCV matrix much simpler. With N assets, there are $[N(N - 1)/2]$ distinct covariance elements in the VCV matrix. For example, if $N = 100$, there are 4,950 distinct covariances to be estimated. The factor model reduces this problem to estimating $[N \times K]$ factor sensitivities plus $[K(K + 1)/2]$ elements of the factor VCV matrix, Ω . With $N = 100$ and $K = 5$, this would mean “only” 500 sensitivities and 15 elements of the factor VCV matrix—almost a 90% reduction in items to estimate. (Of course, we also need to estimate the asset-specific variance terms, v_i^2 , in order to get the N variances, σ_i^2 .) If the factors are chosen well, the factor-based VCV matrix will contain substantially less estimation error than the sample VCV matrix does.

A well-specified factor model can also improve cross-sectional consistency. To illustrate, suppose we somehow know that the true covariance of any asset i with any asset j is proportional to asset i 's covariance with any third asset, k , so

$$\frac{\sigma_{ij}}{\sigma_{ik}} = \text{Constant} \quad (13)$$

for any assets i , j , and k . We would want our estimates to come as close as possible to satisfying this relationship. Sample covariances computed from any given sample of returns will not, in general, do so. However, using Equation 12 with only one factor (i.e., $K = 1$) shows that the covariances from a single-factor model will satisfy

$$\frac{\sigma_{ij}}{\sigma_{ik}} = \frac{\beta_j}{\beta_k} \quad (14)$$

for all assets i , j , and k . Thus, in this simple example, a single-factor model imposes exactly the right cross-sectional structure.

The benefits obtained by imposing a factor structure—handling large numbers of assets, a reduced number of parameters to be estimated, imposition of cross-sectional structure, and a potentially substantial reduction of estimation error—come at a cost. In contrast to the simple example just discussed, in general, the factor model will almost certainly be mis-specified. The structure it imposes will not be exactly right. As a result, the factor-based VCV matrix is *biased*; that is, the expected value is not equal to the true (unobservable) VCV matrix of the returns. To put it differently, the matrix is not correct even “on average.” The matrix is also *inconsistent*; that is, it does not converge to the true matrix as the sample size gets arbitrarily large. In contrast, the sample VCV matrix is unbiased and consistent. Thus, when we use a factor-based matrix instead of the sample VCV matrix, we are choosing to estimate something that is “not quite right” with relative precision rather than the “right thing” with a lot of noise. The point is that although factor models are very useful, they are not a panacea.

7.3 Shrinkage Estimation of VCV Matrices

As with shrinkage estimation in general, the idea here is to combine the information in the sample data, the sample VCV matrix, with an alternative estimate, the target VCV matrix—which reflects assumed “prior” knowledge of the structure of the true VCV matrix—and thereby mitigate the impact of estimation error on the final matrix. Each element (variance or covariance) of the final shrinkage estimate of the VCV matrix is simply a weighted average of the corresponding elements of the sample VCV matrix

and the target VCV matrix. The same weights are used for all elements of the matrix. The analyst must determine how much weight to put on the target matrix (the “prior” knowledge) and how much weight to put on the sample data (the sample VCV matrix).

Aside from a technical condition that rules out the appearance of riskless portfolios, virtually any choice of target VCV matrix will increase (or at least not decrease) the efficiency of the estimates versus the sample VCV matrix. “Efficiency” in this context means a smaller mean-squared error (MSE), which is equal to an estimator’s variance plus the square of its bias. Although the shrinkage estimator is biased, its MSE will in general be smaller than the MSE of the (unbiased) sample VCV matrix. The more plausible (and presumably less biased) the selected target matrix, the greater the improvement will be. A factor-model-based VCV matrix would be a reasonable candidate for the target.

EXAMPLE 9

Estimating the VCV Matrix

Isa Berkitz is an analyst at Barnsby & Culp (B&C), a recently formed multi-family office. Berkitz has been asked to propose the method for estimating the variance–covariance matrix to be used in B&C’s asset allocation process for all clients. After examining the existing client portfolios and talking with the clients and portfolio managers, Berkitz concludes that in order to support B&C’s strategic and tactical allocation needs, the VCV matrix will need to include 25 asset classes. For many of these classes, she will be able to obtain less than 10 years of monthly return data. Berkitz has decided to incorporate both the sample statistics and factor-model approaches using shrinkage estimation.

Explain the strengths and weaknesses of the two basic approaches and why Berkitz would choose to combine them using the shrinkage framework.

Solution:

The VCV matrix based on sample statistics is correct on average (it is unbiased) and converges to the true VCV matrix as the sample size gets arbitrarily large (it is “consistent”). The sample VCV method cannot be used if the number of assets exceeds the number of observations, which is not an issue in this case. However, it is subject to large sampling errors unless the number of observations is large relative to the number of assets. A 10-to-1 rule of thumb would suggest that Berkitz needs more than 250 observations (20+ years of monthly data) in order for the sample VCV matrix to give her reliable estimates, but she has at most 120 observations. In addition, the sample VCV matrix does not impose any cross-sectional consistency on the estimates. A factor-model-based VCV matrix can be used even if the number of assets exceeds the number of observations. It can substantially reduce the number of unique parameters to be estimated, it imposes cross-sectional structure, and it can substantially reduce estimation errors. However, unless the structure imposed by the factor model is exactly correct, the VCV matrix will not be correct on average (it will be biased). Shrinkage estimation—a weighted average of the sample VCV and factor-based VCV matrices—will increase (or at least not decrease) the efficiency of the estimates. In effect, the shrinkage estimator captures the benefits of each underlying methodology and mitigates their respective limitations.

7.4 Estimating Volatility from Smoothed Returns

The available return data for such asset classes as private real estate, private equity, and hedge funds generally reflect smoothing of unobservable underlying “true” returns. The smoothing dampens the volatility of the observed data and distorts correlations with other assets. Thus, the raw data tend to underestimate the risk and overstate the diversification benefits of these asset classes. Failure to adjust for the impact of smoothing will almost certainly lead to distorted portfolio analysis and hence poor asset allocation decisions.

The basic idea is that the observed returns are a weighted average of current and past true, unobservable returns. One of the simplest and most widely used models implies that the current observed return, R_t , is a weighted average of the current true return, r_t , and the previous observed return:

$$R_t = (1 - \lambda)r_t + \lambda R_{t-1} \quad (15)$$

where $0 < \lambda < 1$. From this equation, it can be shown that

$$\text{var}(r) = \left(\frac{1 + \lambda}{1 - \lambda} \right) \text{var}(R) > \text{var}(R) \quad (16)$$

As an example, if $\lambda = 0.8$, then the true variance, $\text{var}(r)$, of the asset is 9 times the variance of the observed data. Equivalently, the standard deviation is 3 times larger.

This model cannot be estimated directly because the true return, r_t , is not observable. To get around this problem, the analyst assumes a relationship between the unobservable return and one or more observable variables. For private real estate, a natural choice might be a REIT index, whereas for private equity, an index of similar publicly traded equities could be used.

EXAMPLE 10

Estimating Volatility from Smoothed Data

While developing the VCV matrix for B&C, Isa Berkitz noted that the volatilities for several asset classes—notably, real estate and private equity categories—calculated directly from available return data appear to be very low. The data are from reputable sources, but Berkitz is skeptical because similar publicly traded classes—for example, REITs and small-cap equities—exhibit much higher volatilities. What is the likely cause of the issue?

Guideline answer:

The very low volatilities are very likely due to smoothing within the reported private asset returns. That is, the observed data reflect a weighted average of current and past true returns. For real estate, this smoothing arises primarily because the underlying property values used to calculate “current” returns are based primarily on backward-looking appraisals rather than concurrent transactions.

7.5 Time-Varying Volatility: ARCH Models

The discussion up to this point has focused on estimating variances and covariances under the assumption that their true values do not change over time. It is well known, however, that financial asset returns tend to exhibit **volatility clustering**, evidenced

by periods of high and low volatility. A class of models known collectively as autoregressive conditional heteroskedasticity (ARCH) models has been developed to address these time-varying volatilities.³¹

One of the simplest and most heavily used forms of this broad class of models specifies that the variance in period t is given by

$$\begin{aligned}\sigma_t^2 &= \gamma + \alpha\sigma_{t-1}^2 + \beta\eta_t^2 \\ &= \gamma + (\alpha + \beta)\sigma_{t-1}^2 + \beta(\eta_t^2 - \sigma_{t-1}^2)\end{aligned}\tag{17}$$

where α , β , and γ are non-negative parameters such that $(\alpha + \beta) < 1$. The term η_t is the unexpected component of return in period t ; that is, it is a random variable with a mean of zero conditional on information at time $(t - 1)$. Rearranging the equation as in the second line shows that $(\eta_t^2 - \sigma_{t-1}^2)$ can be interpreted as the “shock” to the variance in period t . Thus, the variance in period t depends on the variance in period $(t - 1)$ plus a shock. The parameter β controls how much of the current “shock” feeds into the variance. In the extreme, if $\beta = 0$, then variance would be deterministic. The quantity $(\alpha + \beta)$ determines the extent to which the variance in future periods is influenced by the current level of volatility. The higher $(\alpha + \beta)$ is, the more the variance “remembers” what happened in the past and the more it “clusters” at high or low levels. The unconditional expected value of the variance is $[\gamma/(1 - \alpha - \beta)]$.

As an example, assume that $\gamma = 0.000002$, $\alpha = 0.9$, and $\beta = 0.08$ and that we are estimating daily equity volatility. Given these parameters, the unconditional expected value of the variance is 0.0001, implying that the daily standard deviation is 1% (0.01). Suppose the estimated variance at time $(t - 1)$ was 0.0004 ($= 0.02^2$) and the return in period t was 3% above expectations ($\eta_t = 0.03$). Then the variance in period t would be

$$\sigma_t^2 = 0.000002 + (0.9 \times 0.0004) + (0.08 \times 0.03^2) = 0.000434,$$

which is equivalent to a standard deviation of 2.0833%. Without the shock to the variance (i.e., with $\eta_t^2 = \sigma_{t-1}^2 = 0.0004$), the standard deviation would have been 1.9849%. Even without the shock, the volatility would have remained well above its long-run mean of 1.0%. Including the shock, the volatility actually increased. Note that the impact on volatility would have been the same if the return had been 3% *below* expectations rather than above expectations.

The ARCH methodology can be extended to multiple assets—that is, to estimation of a VCV matrix. The most straightforward extensions tend to be limited to only a few assets since the number of parameters rises very rapidly. However, Engle (2002) developed a class of models with the potential to handle large matrices with relatively few parameters.

EXAMPLE 11

ARCH

Sam Akai has noticed that daily returns for a variety of asset classes tend to exhibit periods of high and low volatility but the volatility does seem to revert toward a fairly stable average level over time. Many market participants capture this tendency by estimating volatilities using a 60-day moving window. Akai notes that this method implicitly assumes volatility is constant within each

³¹ Chapter 12 of Campbell, Lo, and MacKinlay (1997) provides an excellent, detailed explanation of these models. The present discussion draws on that book.

60-day window but somehow not constant from one day to the next. He has heard that ARCH models can explicitly incorporate time variation and capture the observed clustering pattern.

Explain the models to him.

Guideline answer:

The key idea is to model variance as a linear time-series process in which the current volatility depends on its own recent history or recent shocks. The shocks to volatility arise from unexpectedly large or small returns. In one of the simplest ARCH models, the current variance depends only on the variance in the previous period and the unexpected component of the current return (squared). Provided the coefficients are positive and not “too large,” the variance will exhibit the properties Akai has observed: periods of time at high/low levels relative to a well-defined average level.

8

ADJUSTING A GLOBAL PORTFOLIO

The coverage of capital market expectations has provided an intensive examination of topics with which analysts need to be familiar in order to establish capital market expectations for client portfolios. This section brings some of this material together to illustrate how analysts can develop and justify recommendations for adjusting a portfolio. The discussion that follows is selective in the range of assets and scenarios it considers. It focuses on connecting expectations to the portfolio and is about “direction of change” rather than the details of specific forecasts.

8.1 Macro-Based Recommendations

Suppose we start with a fairly generic portfolio of global equities and bonds (we assume no other asset classes are included or considered) and we are asked to recommend changes based primarily on macroeconomic considerations. Further assume that the portfolio reflects a reasonable strategic allocation for our clients. Hence, we do not need to make any wholesale changes and can focus on incremental improvements based on assessment of current opportunities. To be specific, we limit our potential recommendations to the following:

- Change the overall allocations to equities and bonds.
- Reallocate equities/bonds between countries.
- Adjust the average credit quality of our bond portfolios.
- Adjust duration and positioning on the yield curves.
- Adjust our exposures to currencies.

To approach the task systematically, we begin with a checklist of questions.

- 1 Have there been significant changes in the drivers of trend growth, globally or in particular countries?
- 2 Are any of the markets becoming more/less globally integrated?
- 3 Where does each country stand within its business cycle? Are they synchronized?
- 4 Are monetary and fiscal policies consistent with long-term stability and the phases of the business cycle?

- 5 Are current account balances trending and sustainable?
- 6 Are any currencies under pressure to adjust or trending? Have capital flows driven any currencies to extended levels? Have any of the economies become uncompetitive/super-competitive because of currency movements?

There are certainly many more questions we could ask. In practice, the analyst will need to look into the details. But these questions suffice for our illustration. We will examine each in turn. It must be noted, however, that they are inherently interrelated.

Trend Growth

All else the same, an increase in trend growth favors equities because it implies more rapid long-run earnings growth. Faster growth due to productivity is especially beneficial. In contrast, higher trend growth generally results in somewhat higher real interest rates, a negative for currently outstanding bonds. Identifiable changes in trend growth that have not already been fully factored into asset prices are most likely to have arisen from a shock (e.g., new technology). A global change would provide a basis for adjusting the overall equity/bond allocation. Country-specific or regional changes provide a basis for reallocation within equities toward the markets experiencing enhanced growth prospects that have not already been reflected in market prices.

Global Integration

All else the same, the Singer–Terhaar model implies that when a market becomes more globally integrated, its required return should decline. As prices adjust to a lower required return, the market should deliver an even higher return than was previously expected or required by the market. Therefore, expected increases in integration provide a rationale for adjusting allocations toward those markets and reductions in markets that are already highly integrated. Doing so will typically entail a shift from developed markets to emerging markets.

Phases of the Business Cycle

The best time to buy equities is generally when the economy is approaching the trough of the business cycle. Valuation multiples and expected earnings growth rates are low and set to rise. The Grinold–Kroner model could be used to formalize a recommendation to buy equities. At this stage of the cycle, the term premium is high (the yield curve is steep) and the credit premium is high (credit spreads are wide). However, (short-term) interest rates are likely to start rising soon and the yield curve can be expected to flatten again as the economy gains strength. All else the same, the overall allocation to bonds will need to be reduced to facilitate the increased allocation to equities. Within the bond portfolio, overall duration should be reduced, positions with intermediate maturities should be reduced in favor of shorter maturities (and perhaps a small amount of longer maturities) to establish a “barbell” posture with the desired duration, and exposure to credit should be increased (a “down in quality” trade). The opposite recommendations would apply when the analyst judges that the economy is at or near the peak of the cycle.

To the extent that business cycles are synchronized across markets, this same prescription would apply to the overall portfolio. It is likely, however, that some markets will be out of phase—leading or lagging other markets—by enough to warrant reallocations between markets. In this case, the recommendation would be to reallocate equities from (to) markets nearest the peak (trough) of their respective cycles and to do the opposite within the bond portfolio with corresponding adjustments to duration, yield curve positioning, and credit exposure within each market.

Monetary and Fiscal Policies

Investors devote substantial energy dissecting every nuance of monetary and fiscal policy. If policymakers are doing what we would expect them to be doing at any particular stage of the business cycle—for example, moderate countercyclical actions and attending to longer-term objectives, such as controlling inflation and maintaining fiscal discipline—their activities may already be reflected in asset prices. In addition, the analyst should have factored expected policy actions into the assessment of trend growth and business cycles.

Significant opportunities to add value by reallocating the portfolio are more likely to arise from structural policy changes (e.g., a shift from interest rate targeting to money growth targeting, quantitative easing, and restructuring of the tax code) or evidence that the response to policy measures is not within the range of outcomes that policymakers would have expected (e.g., if massive quantitative easing induced little inflation response). Structural policy changes are clearly intentional and the impact on the economy and the markets is likely to be consistent with standard macroeconomic analysis, so the investment recommendations will follow from the implications for growth trends and business cycles. Almost by definition, standard modes of analysis may be ineffective if policy measures have not induced the expected responses. In this case, the analyst's challenge is to determine what, why, and how underlying linkages have changed and identify the value-added opportunities.

Current Account Balances

Current account balances ultimately reflect national saving and investment decisions, including the fiscal budget. Current accounts must, of course, net out across countries. In the short run, this is brought about in large measure by the fact that household saving and corporate profits (business saving) are effectively residuals whereas consumption and capital expenditures are more explicitly planned. Hence, purely cyclical fluctuations in the current account are just part of the business cycle. Longer-term trends in the current account require adjustments to induce deliberate changes in saving/investment decisions. A rising current account deficit will tend to put upward pressure on real required returns (downward pressure on asset prices) in order to induce a higher saving rate in the deficit country (to mitigate the widening deficit) and to attract the increased flow of capital from abroad required to fund the deficit. An expanding current account surplus will, in general, require the opposite in order to reduce "excess" saving. This suggests that the analyst should consider reallocation of portfolio assets from countries with secularly rising current account deficits to those with secularly rising current account surpluses (or narrowing deficits).

Capital Accounts and Currencies

Setting aside very high inflation situations in which purchasing power parity may be important even in the short term, currencies are primarily influenced by capital flows. When investors perceive that the portfolio of assets denominated in a particular currency offers a higher risk-adjusted expected return than is available in other currencies, the initial surge of capital tends to drive the exchange rate higher, often to a level from which it is more likely to depreciate rather than continue to appreciate. At that point, the underlying assets may remain attractive in their native currency but not in conjunction with the currency exposure. An analyst recommending reallocation of a portfolio toward assets denominated in a particular currency must, therefore, assess whether the attractiveness of the assets has already caused an "overshoot" in the currency or whether a case can be made that there is meaningful appreciation yet to come. In the former case, the analyst needs to consider whether the assets remain attractive after taking account of the cost of currency hedging.

There is one final question that needs to be addressed for all asset classes and currencies. The previous discussion alluded to it, but it is important enough to be asked directly: *What is already reflected in asset prices?* There is no avoiding the fact that valuations matter.

8.2 Quantifying the Views

Although the analyst may not be required to quantify the views underlying his or her recommendations, we can very briefly sketch a process that may be used for doing so using some of the tools discussed in earlier sections.

- Step 1 Use appropriate techniques to estimate the VCV matrix for all asset classes.
- Step 2 Use the Singer–Terhaar model and the estimated VCV matrix to determine equilibrium expected returns for all asset classes.
- Step 3 Use the Grinold–Kroner model to estimate returns for equity markets based on assessments of economic growth, earnings growth, valuation multiples, dividends, and net share repurchases.
- Step 4 Use the building block approach to estimate expected returns for bond classes based primarily on cyclical and policy considerations.
- Step 5 Establish directional views on currencies relative to the portfolio's base currency based on the perceived attractiveness of assets and the likelihood of having overshot sustainable levels. Set modest rates of expected appreciation/depreciation.
- Step 6 Incorporate a currency component into expected returns for equities and bonds.
- Step 7 Use the Black–Litterman framework (described in a later reading) to combine equilibrium expected returns from Step 2 with the expected returns determined in Steps 3–6.

SUMMARY

The following are the main points covered in the reading.

- The choice among forecasting techniques is effectively a choice of the information on which forecasts will be conditioned and how that information will be incorporated into the forecasts.
- The formal forecasting tools most commonly used in forecasting capital market returns fall into three broad categories: statistical methods, discounted cash flow models, and risk premium models.
- Sample statistics, especially the sample mean, are subject to substantial estimation error.
- Shrinkage estimation combines two estimates (or sets of estimates) into a more precise estimate.
- Time-series estimators, which explicitly incorporate dynamics, may summarize historical data well without providing insight into the underlying drivers of forecasts.
- Discounted cash flow models are used to estimate the required return implied by an asset's current price.

- The risk premium approach expresses expected return as the sum of the risk-free rate of interest and one or more risk premiums.
- There are three methods for modeling risk premiums: equilibrium models, such as the CAPM; factor models; and building blocks.
- The DCF method is the only one that is precise enough to use in support of trades involving individual fixed-income securities.
- There are three main methods for developing expected returns for fixed-income asset classes: DCF, building blocks, and inclusion in an equilibrium model.
- As a forecast of bond return, YTM, the most commonly quoted metric, can be improved by incorporating the impact of yield changes on reinvestment of cash flows and valuation at the investment horizon.
- The building blocks for fixed-income expected returns are the short-term default-free rate, the term premium, the credit premium, and the liquidity premium.
- Term premiums are roughly proportional to duration, whereas credit premiums tend to be larger at the short end of the curve.
- Both term premiums and credit premiums are positively related to the slope of the yield curve.
- Credit spreads reflect both the credit premium (i.e., additional expected return) and expected losses due to default.
- A baseline estimate of the liquidity premium can be based on the yield spread between the highest-quality issuer in a market (usually the sovereign) and the next highest-quality large issuer (often a government agency).
- Emerging market debt exposes investors to heightened risk with respect to both ability to pay and willingness to pay, which can be associated with the economy and political/legal weaknesses, respectively.
- The Grinold–Kroner model decomposes the expected return on equities into three components: (1) expected cash flow return, composed of the dividend yield minus the rate of change in shares outstanding, (2) expected return due to nominal earnings growth, and (3) expected repricing return, reflecting the rate of change in the P/E.
- Forecasting the equity premium directly is just as difficult as projecting the absolute level of equity returns, so the building block approach provides little, if any, specific insight with which to improve equity return forecasts.
- The Singer–Terhaar version of the international capital asset pricing model combines a global CAPM equilibrium that assumes full market integration with expected returns for each asset class based on complete segmentation.
- Emerging market equities expose investors to the same underlying risks as emerging market debt does: more fragile economies, less stable political and policy frameworks, and weaker legal protections.
- Emerging market investors need to pay particular attention to the ways in which the value of their ownership claims might be expropriated. Among the areas of concern are standards of corporate governance, accounting and disclosure standards, property rights laws, and checks and balances on governmental actions.
- Historical return data for real estate is subject to substantial smoothing, which biases standard volatility estimates downward and distorts correlations with other asset classes. Meaningful analysis of real estate as an asset class requires explicit handling of this data issue.

- Real estate is subject to boom–bust cycles that both drive and are driven by the business cycle.
- The cap rate, defined as net operating income in the current period divided by the property value, is the standard valuation metric for commercial real estate.
- A model similar to the Grinold–Kroner model can be applied to estimate the expected return on real estate:

$$E(R_{re}) = \text{Cap rate} + \text{NOI growth rate} - \% \Delta \text{Cap rate}.$$

- There is a clear pattern of higher cap rates for riskier property types, lower-quality properties, and less attractive locations.
- Real estate expected returns contain all the standard building block risk premiums:
 - Term premium: As a very long-lived asset with relatively stable cash flows, income-producing real estate has a high duration.
 - Credit premium: A fixed-term lease is like a corporate bond issued by the leaseholder and secured by the property.
 - Equity premium: Owners bear the risk of property value fluctuations, as well as risk associated with rent growth, lease renewal, and vacancies.
 - Liquidity premium: Real estate trades infrequently and is costly to transact.
- Currency exchange rates are especially difficult to forecast because they are tied to governments, financial systems, legal systems, and geographies. Forecasting exchange rates requires identification and assessment of the forces that are likely to exert the most influence.
- Provided they can be financed, trade flows do not usually exert a significant impact on exchange rates. International capital flows are typically larger and more volatile than trade-financing flows.
- PPP is a poor predictor of exchange rate movements over short to intermediate horizons but is a better guide to currency movements over progressively longer multi-year horizons.
- The extent to which the current account balance influences the exchange rate depends primarily on whether it is likely to be persistent and, if so, whether it can be sustained.
- Capital seeks the highest risk-adjusted expected return. In a world of perfect capital mobility, in the long run, the exchange rate will be driven to the point at which the expected percentage change equals the “excess” risk-adjusted expected return on the portfolio of assets denominated in the domestic currency over that of the portfolio of assets denominated in the foreign currency. However, in the short run, there can be an exchange rate overshoot in the opposite direction as hot money chases higher returns.
- Carry trades are profitable on average, which is contrary to the predictions of uncovered interest rate parity.
- Each country/currency has a unique portfolio of assets that makes up part of the global “market portfolio.” Exchange rates provide an across-the-board mechanism for adjusting the relative sizes of these portfolios to match investors’ desire to hold them.
- The portfolio balance perspective implies that exchange rates adjust in response to changes in the relative sizes and compositions of the aggregate portfolios denominated in each currency.
- The sample variance–covariance matrix is an unbiased estimate of the true VCV structure; that is, it will be correct on average.

- There are two main problems with using the sample VCV matrix as an estimate/forecast of the true VCV matrix: It cannot be used for large numbers of asset classes, and it is subject to substantial sampling error.
- Linear factor models impose structure on the VCV matrix that allows them to handle very large numbers of asset classes. The drawback is that the VCV matrix is biased and inconsistent unless the assumed structure is true.
- Shrinkage estimation of the VCV matrix is a weighted average of the sample VCV matrix and a target VCV matrix that reflects assumed “prior” knowledge of the true VCV structure.
- Failure to adjust for the impact of smoothing in observed return data for real estate and other private assets will almost certainly lead to distorted portfolio analysis and hence poor asset allocation decisions.
- Financial asset returns exhibit volatility clustering, evidenced by periods of high and low volatilities. ARCH models were developed to address these time-varying volatilities.
- One of the simplest and most used ARCH models represents today’s variance as a linear combination of yesterday’s variance and a new “shock” to volatility. With appropriate parameter values, the model exhibits the volatility clustering characteristic of financial asset returns.

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PRACTICE PROBLEMS

- 1** An investor is considering adding three new securities to her internationally focused fixed income portfolio. She considers the following non-callable securities:

- 1-year government bond
- 10-year government bond
- 10-year BBB rated corporate bond

She plans to invest equally in all three securities being analyzed or will invest in none of them at this time. She will only make the added investment provided that the expected spread/premium of the equally weighted investment is at least 1.5 percent (150bp) over the 1-year government bond. She has gathered the following information:

Risk free interest rate (1-year, incorporating 2.6% inflation expectation)	3.8%
Term premium (10-year vs. 1-year government bond)	1%
10-year BBB credit premium (over 10-year government bond)	75bp
Estimated liquidity premium on 10-year corporate bonds	55bp

Using only the information given, address the following problems using the risk premium approach:

- A** Calculate the expected return that an equal-weighted investment in the three securities could provide.
- B** Calculate the expected total risk premium of the three securities and determine the investor's probable course of action.
- 2** Jo Akumba's portfolio is invested in a range of developed markets fixed income securities. She asks her adviser about the possibility of diversifying her investments to include emerging and frontier markets government and corporate fixed income securities. Her adviser makes the following comment regarding risk:

"All emerging and frontier market fixed income securities pose economic, political and legal risk. Economic risks arise from the fact that emerging market countries have poor fiscal discipline, rely on foreign borrowing, have less diverse tax base and significant dependence on specific industries. They are susceptible to capital flight. Their ability to pay is limited. In addition, weak property rights, weak enforcement of contract laws and political instability pose hazard for emerging markets debt investors."

Discuss the statement made.

- 3** An Australian investor currently holds a A\$240 million equity portfolio. He is considering rebalancing the portfolio based on an assessment of the risk and return prospects facing the Australian economy. Information relating to the Australian investment markets and the economy has been collected in the following table:

10-Year Historical	Current	Capital Market Expectations
Average government bond yield: 2.8%	10-year government bond yield: 2.3%	
Average annual equity return: 4.6%	Year-over-year equity return: -9.4%	
Average annual inflation rate: 2.3%	Year-over-year inflation rate: 2.1%	Expected annual inflation: 2.3%
Equity market P/E (beginning of period): 15×	Current equity market P/E: 14.5×	Expected equity market P/E: 14.0×
Average annual dividend income return: 2.6%		Expected annual income return: 2.4%
Average annual real earnings growth: 6.0%		Expected annual real earnings growth: 5.0%

Using the information in the table, address the following problems:

- A** Calculate the historical Australian equity risk premium using the “equity-vs-bonds” premium method.
 - B** Calculate the expected annual equity return using the Grinold–Kroner model (assume no change in the number of shares outstanding).
 - C** Using your answer to Part B, calculate the expected annual equity risk premium.
- 4** An analyst is reviewing various asset alternatives and is presented with the following information relating to the broad equity market of Switzerland and various industries within the Swiss market that are of particular investment interest.

Expected risk premium for overall global investable market (GIM) portfolio	3.5%
Expected standard deviation for the GIM portfolio	8.5%
Expected standard deviation for Swiss Healthcare Industry equity investments	12.0%
Expected standard deviation for Swiss Watch Industry equity investments	6.0%
Expected standard deviation for Swiss Consumer Products Industry equity investments	7.5%

Assume that the Swiss market is perfectly integrated with the world markets.

Swiss Healthcare has a correlation of 0.7 with the GIM portfolio.

Swiss Watch has a correlation of 0.8 with the GIM portfolio.

Swiss Consumer Products has a correlation of 0.8 with the GIM portfolio.

- A** Basing your answers only upon the data presented in the table above and using the international capital asset pricing model—in particular, the Singer–Terhaar approach—estimate the expected risk premium for the following:
 - i.** Swiss Health Care Industry
 - ii.** Swiss Watch Industry
 - iii.** Swiss Consumer Products Industry
 - B** Judge which industry is most attractive from a valuation perspective.
- 5** Identify risks faced by investors in emerging market equities over and above those that are faced by fixed income investors in such markets.

- 6** Describe the main issues that arise when conducting historical analysis of real estate returns.
- 7** An analyst at a real estate investment management firm seeks to establish expectations for rate of return for properties in the industrial sector over the next year. She has obtained the following information:

Current industrial sector capitalization rate ("cap" rate)	5.7%
Expected cap rate at the end of the period	5.5%
NOI growth rate (real)	1%
Inflation expectation	1.5%

Estimate the expected return from the industrial sector properties based on the data provided.

- 8** A client has asked his adviser to explain the key considerations in forecasting exchange rates. The adviser's firm uses two broad complementary approaches when setting expectations for exchange rate movements, namely focus on trade in goods and services and, secondly, focus on capital flows. Identify the main considerations that the adviser should explain to the client under the two approaches.
- 9** Looking independently at each of the economic observations below, indicate the country where an analyst would expect to see a strengthening currency for each observation.

	Country X	Country Y
Expected inflation over next year	2.0%	3.0%
Short-term (1-month) government rate	Decrease	Increase
Expected (forward-looking) GDP growth over next year	2.0%	3.3%
New national laws have been passed that enable foreign direct investment in real estate/financial companies	Yes	No
Current account surplus (deficit)	8%	-1%

- 10** Fap is a small country whose currency is the Fip. Three years ago, the exchange rate was considered to be reflecting purchasing power parity (PPP). Since then, the country's inflation has exceeded inflation in the other countries by about 5% per annum. The Fip exchange rate, however, remained broadly unchanged.

What would you have expected the Fip exchange rate to show if PPP prevailed?

Are Fips over or undervalued, according to PPP?

SOLUTIONS

1 A

	Risk free interest rate (nominal) (%)	+	Premiums (%)	=	Expected annual fixed-income return (%)
1-year government bond	3.8	+	0	=	3.8
10-year government bond	3.8	+	1	=	4.8
10-year corporate bond	3.8	+	1 + 0.75 + 0.55	=	6.1

Estimate of the expected return of an equal-weighted investment in the three securities: $(3.8\% + 4.8\% + 6.1\%)/3 = 4.9\%$.

- B The average spread (over 1-year government bond) at issue is $[0 + 1 + (1 + 0.75 + 0.55)] = 3.3\%/3 = 1.1\%$.

As the 1.1% is less than 1.5%, the investor will not make the investment.

- 2 The statement correctly identifies economic, political and legal risk. The adviser has correctly identified some of the characteristics typically associated with emerging and frontier markets that may affect their governments' and corporate borrowers' ability and willingness to pay bondholders. However, the assertion that all emerging and frontier market fixed income securities pose such risk is incorrect, as many countries classified as "emerging" are considered to be healthy and prosperous economies.

- 3 A The historical equity risk premium is 1.8%, calculated as follows:

$$\text{Historical equity returns} - \text{Historical 10-year government bond yield} = \\ \text{Historical equity risk premium}$$

$$4.6\% - 2.8\% = 1.8\%$$

- B The Grinold–Kroner model states that the expected return on equity is the sum of the expected income return (2.4%), the expected nominal earnings growth return ($7.3\% = 2.3\% \text{ from inflation} + 5.0\% \text{ from real earnings growth}$) and the expected repricing return (-3.45%). The expected change in market valuation of -3.45% is calculated as the percentage change in the P/E level from the current $14.5\times$ to the expected level of $14.0\times$: $(14 - 14.5)/14.5 = -3.45\%$. Thus, the expected return is $2.4\% + 7.3\% - 3.45\% = 6.25\%$.

- C Using the results from Part B, the expected equity return is 6.25 percent.

$$\text{Expected equity return} - \text{Current 10-year government bond yield} = \\ \text{Expected equity risk premium}$$

$$6.25\% - 2.3\% = 3.95\%.$$

- 4 A Using the formula $RP_i^G = \rho_{i,GM}\sigma_i\left(\frac{RP_{GM}}{\sigma_{GM}}\right)$ we can solve for each expected industry risk premium. The term in brackets is the Sharpe ratio for the GIM, computed as $3.5/8.5 = 0.412$.

i. $RP_{\text{Healthcare}} = (12)(0.7)(0.412) = 3.46\%$

$$\text{ii. } RP_{\text{Watch}} = (6)(0.8)(0.412) = 1.98\%$$

$$\text{iii. } RP_{\text{Consumer Products}} = (7.5)(0.8)(0.412) = 2.47\%$$

- B** Based on the above analysis, the Swiss Healthcare Industry would have the highest expected return. However, that expected return reflects compensation for systematic risk. Based on the data provided we cannot conclude which industry is most attractive from a valuation standpoint.
- 5 In addition to the economic, political and legal risks faced by fixed income investors, equity investors in emerging markets face corporate governance risks. Their ownership claims may be expropriated by corporate insiders, dominant shareholders or the government. Interested parties may misuse the companies' assets. Weak disclosure and accounting standards may result in limited transparency that favors insiders. Weak checks and balances on governmental actions may bring about regulatory uncertainty, seizure of property or nationalization.
- 6 Properties trade infrequently so there is no data on simultaneous periodic transaction prices for a selection of properties. Analysis therefore relies on appraisals. Secondly, each property is different, it is said to be heterogenous. The returns calculated from appraisals represent weighted averages of unobservable returns. Published return series is too smooth and the sample volatility understates the true volatility of returns. It also distorts estimates of correlations.
- 7 The expected change in the cap rate from 5.7% to 5.5% represents a $(5.5\% - 5.7\%)/5.7\% = 3.5\%$ decrease.
Using the expression $E(R_{re}) = \text{CapRate} + \text{NOI growth rate} - \% \Delta \text{CapRate} = 5.7\% + (1\% + 1.5\%) - (-3.5\%) = 11.7\%$.
Note: As the cap rate is expected to decrease, property values are expected to increase, hence the cap rate change contributes to the expected return.
- 8 Under the first approach analysts focus on flows of export and imports to establish what the net trade flows are and how large they are relative to the economy and other, potentially larger financing and investment flows. The approach also considers differences between domestic and foreign inflation rates that relate to the concept of purchasing power parity. Under PPP, the expected percentage change in the exchange rate should equal the difference between inflation rates. The approach also considers the sustainability of current account imbalances, reflecting the difference between national saving and investment.
Under the second approach the analysis focuses on capital flows and the degree of capital mobility. It assumes that capital seeks the highest risk-adjusted return. The expected changes in the exchange rate will reflect the differences in the respective countries' assets' characteristics such as relative short-term interest rates, term, credit, equity and liquidity premiums. The approach also considers hot money flows and the fact that exchange rates provide an across the board mechanism for adjusting the relative sizes of each country's portfolio of assets.

9

	Country X	Country Y
Expected inflation over next year	2.0%	3.0%
Short-term (1-month) government rate	Decrease	Increase
Expected (forward-looking) GDP growth over next year	2.0%	3.3%

	Country X	Country Y
New national laws have been passed that enable foreign direct investment in real estate/financial companies	Yes	No
Current account surplus (deficit)	8%	-1%

Note: The shaded cells represent the comparatively stronger measure, where an analyst could expect to see a strengthening currency based on the factor being independently reviewed.

- 10** According to PPP, to offset the effect of the higher inflation in Fap, the Fip should have depreciated against the other currencies by approximately the difference between Fap inflation and that in the other countries.

According to PPP, Fip is overvalued.

Glossary

Absolute return benchmark A minimum target return that an investment manager is expected to beat.

Accounting defeasance Also called in-substance defeasance, accounting defeasance is a way of extinguishing a debt obligation by setting aside sufficient high-quality securities to repay the liability.

Accumulation phase Phase where the government predominantly contributes to a sovereign wealth pension reserve fund.

Active management An approach to investing in which the portfolio manager seeks to outperform a given benchmark portfolio.

Active return The portfolio's return in excess of the return on the portfolio's benchmark.

Active risk The annualized standard deviation of active returns, also referred to as *tracking error* (also sometimes called *tracking risk*).

Active risk budgeting Risk budgeting that concerns active risk (risk relative to a portfolio's benchmark).

Active share A measure, ranging from 0% to 100%, of how similar a portfolio is to its benchmark. The measure is based on the differences in a portfolio's holdings and weights relative to its benchmark's holdings and their weights. 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 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.

Activist short selling A hedge fund strategy in which the manager takes a short position in a given security and then publicly presents his/her research backing the short thesis.

Adaptive markets hypothesis (AMH) A hypothesis that applies principles of evolution—such as competition, adaptation, and natural selection—to financial markets in an attempt to reconcile efficient market theories with behavioral alternatives.

Agency trade A trade in which the broker is engaged to find the other side of the trade, acting as an agent. In doing so, the broker does not assume any risk for the trade.

Alpha decay In a trading context, alpha decay is the erosion or deterioration in short term alpha after the investment decision has been made.

Alternative trading systems (ATS) Non-exchange trading venues that bring together buyers and sellers to find transaction counterparties. Also called *multilateral trading facilities* (MTF).

Anchoring and adjustment An information-processing bias in which the use of a psychological heuristic influences the way people estimate probabilities.

Anchoring and adjustment bias An information-processing bias in which the use of a psychological heuristic influences the way people estimate probabilities.

Anomalies Apparent deviations from market efficiency.

Arithmetic attribution An attribution approach which explains the arithmetic difference between the portfolio return and its benchmark return. The single-period attribution effects sum to the excess return, however, when combining multiple periods, the sub-period attribution effects will not sum to the excess return.

Arrival price In a trading context, the arrival price is the security price at the time the order was released to the market for execution.

Aspirational risk bucket In goal-based portfolio planning, that part of wealth allocated to investments that have the potential to increase a client's wealth substantially.

Asset location The type of account an asset is held within, e.g., taxable or tax deferred.

Asset-only With respect to asset allocation, an approach that focuses directly on the characteristics of the assets without explicitly modeling the liabilities.

Authorized participants Broker/dealers who enter into an agreement with the distributor of the fund.

Availability bias An information-processing bias in which people take a heuristic approach to estimating the probability of an outcome based on how easily the outcome comes to mind.

Back-fill bias The distortion in index or peer group data which results when returns are reported to a database only after they are known to be good returns.

Barbell A fixed income portfolio combining securities concentrated in short and long maturities relative to the benchmark.

Base With respect to a foreign exchange quotation of the price of one unit of a currency, the currency referred to in "one unit of a currency."

Base-rate neglect A type of representativeness bias in which the base rate or probability of the categorization is not adequately considered.

Basis risk The risk resulting from using a hedging instrument that is imperfectly matched to the investment being hedged; in general, the risk that the basis will change in an unpredictable way.

Bayes' formula A mathematical rule explaining how existing probability beliefs should be changed given new information; it is essentially an application of conditional probabilities.

Bear spread An option strategy that becomes more valuable when the price of the underlying asset declines, so requires buying one option and writing another with a *lower* exercise price. A put bear spread involves buying a put with a higher exercise price and selling a put with a lower exercise price. A bear spread can also be executed with calls.

Behavioral biases A tendency to behave in a way that is not strictly rational.

Behavioral finance macro A focus on market level behavior that considers market anomalies that distinguish markets from the efficient markets of traditional finance.

Behavioral finance micro A focus on individual level behavior that examines the behavioral biases that distinguish individual investors from the rational decision makers of traditional finance.

Benchmark spread The yield on a credit security over the yield on a security with little or no credit risk (benchmark bond) and with a similar duration.

Best-in-class An ESG implementation approach that seeks to identify the most favorable companies and sectors based on ESG considerations. Also called *positive screening*.

Bid price In a price quotation, the price at which the party making the quotation is willing to buy a specified quantity of an asset or security.

Bottom-up approach A credit strategy approach that involves selecting the individual bonds or issuers that the investor views as having the best relative value from among a set of bonds or issuers with similar features.

Bounded rationality The notion that people have informational and cognitive limitations when making decisions and do not necessarily optimize when arriving at their decisions.

Breadth The number of truly independent decisions made each year.

Brinson model The approach to return attribution established in various papers co-authored by Gary Brinson; the Brinson–Hood–Beebower and Brinson–Fachler models viewed as a group. The value added by the portfolio manager is decomposed in allocation, selection, and interaction effects.

Buffering Establishing ranges around breakpoints that define whether a stock belongs in one index or another.

Bull spread An option strategy that becomes more valuable when the price of the underlying asset rises, so requires buying one option and writing another with a *higher* exercise price. A call bull spread involves buying a call with a lower exercise price and selling a call with a higher exercise price. A bull spread can also be executed with puts.

Bullet A fixed income portfolio made up of securities targeting a single segment of the curve.

Business cycle Fluctuations in GDP in relation to long-term trend growth, usually lasting 9–11 years.

Butterfly spread An option strategy that combines two bull or bear spreads and has three exercise prices, or, a measure of yield curve curvature.

Calendar rebalancing Rebalancing a portfolio to target weights on a periodic basis; for example, monthly, quarterly, semiannually, or annually.

Calendar spread A strategy in which one sells an option and buys the same type of option but with different expiration dates, on the same underlying asset and with the same strike. When the investor buys the more distant (near-term) call and sells the near-term (more distant) call, it is a long (short) calendar spread.

Canada model Characterized by a high allocation to alternatives. Unlike the endowment model, however, the Canada model relies more on internally managed assets. The innovative features of the Canada model are the: a) reference portfolio, b) total portfolio approach, and c) active management.

Capital market expectations (CME) Expectations concerning the risk and return prospects of asset classes.

Capital needs analysis See *capital sufficiency analysis*.

Capital sufficiency analysis The process by which a wealth manager determines whether a client has, or is likely to accumulate, sufficient financial resources to meet his or her objectives; also known as *capital needs analysis*.

Capture ratio A measure of the manager's gain or loss relative to the gain or loss of the benchmark.

Carhart model A four factor model used in performance attribution. The four factors are: market (RMRF), size (SMB), value (HML), and momentum (WML).

Carry trade A trading strategy that involves buying a security and financing it at a rate that is lower than the yield on that security.

Cash drag Tracking error caused by temporarily uninvested cash.

Cash flow matching Immunization approach that attempts to ensure that all future liability payouts are matched precisely by cash flows from bonds or fixed-income derivatives, such as interest rate futures, options, or swaps.

Cash-secured put An option strategy involving the writing of a put option and simultaneously depositing an amount of money equal to the exercise price into a designated account (this strategy is also called a fiduciary put).

Cell approach See *stratified sampling*.

Certainty equivalent The maximum sum of money a person would pay to participate or the minimum sum of money a person would accept to not participate in an opportunity.

Civil law A legal system derived from Roman law, in which judges apply general, abstract rules or concepts to particular cases. In civil systems, law is developed primarily through legislative statutes or executive action.

Closet indexer A fund that advertises itself as being actively managed but is substantially similar to an index fund in its exposures.

Code of ethics An established guide that communicates an organization's values and overall expectations regarding member behavior. A code of ethics serves as a general guide for how community members should act.

Cognitive dissonance The mental discomfort that occurs when new information conflicts with previously held beliefs or cognitions.

Cognitive errors Behavioral biases resulting from faulty reasoning; cognitive errors stem from basic statistical, information processing, or memory errors.

Collar An option position in which the investor is long shares of stock and then buys a put with an exercise price below the current stock price and writes a call with an exercise price above the current stock price. Collars allow a shareholder to acquire downside protection through a protective put but reduce the cash outlay by writing a covered call.

Common law A legal system which draws abstract rules from specific cases. In common law systems, law is developed primarily through decisions of the courts.

Community property regime A marital property regime under which each spouse has an indivisible one-half interest in property received during marriage.

Company-specific risk The non-systematic or idiosyncratic risk specific to a particular company's operations, reputation, and business environment.

Completion overlay A type of overlay that addresses an indexed portfolio that has diverged from its proper exposure.

Confirmation bias A belief perseverance bias in which people tend to look for and notice what confirms their beliefs, to ignore or undervalue what contradicts their beliefs, and to misinterpret information as support for their beliefs.

Conjunction fallacy An inappropriate combining of probabilities of independent events to support a belief. In fact, the probability of two independent events occurring in conjunction is never greater than the probability of either event occurring alone; the probability of two independent events occurring together is equal to the multiplication of the probabilities of the independent events.

Conservatism bias A belief perseverance bias in which people maintain their prior views or forecasts by inadequately incorporating new information.

Contingent immunization Hybrid approach that combines immunization with an active management approach when the asset portfolio's value exceeds the present value of the liability portfolio.

Controlled foreign corporation A company located outside a taxpayer's home country and in which the taxpayer has a controlling interest as defined under the home country law.

Convexity A measure of how interest rate sensitivity changes with a change in interest rates.

Core capital The amount of capital required to fund spending to maintain a given lifestyle, fund goals, and provide adequate reserves for unexpected commitments.

Covered call An option strategy in which a long position in an asset is combined with a short position in a call on that asset.

Creation units Large blocks of ETF shares often traded against a basket of underlying securities.

Credit method When the residence country reduces its taxpayers' domestic tax liability by the amount of taxes paid to a foreign country that exercises source jurisdiction.

Credit risk The risk of loss caused by a counterparty's or debtor's failure to make a timely payment or by the change in value of a financial instrument based on changes in default risk. Also called *default risk*.

Cross-currency basis swap A swap in which notional principals are exchanged because the goal of the transaction is to issue at a more favorable funding rate and swap the amount back to the currency of choice.

Cross hedge A hedge involving a hedging instrument that is imperfectly correlated with the asset being hedged; an example is hedging a bond investment with futures on a non-identical bond.

Cross-sectional consistency A feature of expectations setting which means that estimates for all classes reflect the same underlying assumptions and are generated with methodologies that reflect or preserve important relationships among the asset classes, such as strong correlations. It is the internal consistency across asset classes.

Cross-sectional momentum A managed futures trend following strategy implemented with a cross-section of assets (within an asset class) by going long those that are rising in price the most and by shorting those that are falling the most. This approach generally results in holding a net zero (market-neutral) position and works well when a market's out- or underperformance is a reliable predictor of its future performance.

Currency overlay A type of overlay that helps hedge the returns of securities held in foreign currency back to the home country's currency.

Currency overlay programs A currency overlay program is a program to manage a portfolio's currency exposures for the case in which those exposures are managed separately from the management of the portfolio itself.

Custom security-based benchmark Benchmark that is custom built to accurately reflect the investment discipline of a particular investment manager. Also called a *strategy benchmark* because it reflects a manager's particular strategy.

Decision price In a trading context, the decision price is the security price at the time the investment decision was made.

Decision-reversal risk The risk of reversing a chosen course of action at the point of maximum loss.

Decumulation phase Phase where the government predominantly withdraws from a sovereign wealth pension reserve fund.

Dedicated short-selling A hedge fund strategy in which the manager takes short-only positions in equities deemed to be expensively priced versus their deteriorating fundamental situations. Short exposures may vary only in terms of portfolio sizing by, at times, holding higher levels of cash.

Deduction method When the residence country allows taxpayers to reduce their taxable income by the amount of taxes paid to foreign governments in respect of foreign-source income.

Deemed dispositions Tax treatment that assumes property is sold. It is sometimes seen as an alternative to estate or inheritance tax.

Deemed distribution When shareholders of a controlled foreign corporation are taxed as if the earnings were distributed to shareholders, even though no distribution has been made.

Default risk The probability that a borrower defaults or fails to meet its obligation to make full and timely payments of principal and interest, according to the terms of the debt security.

Deferred annuity An annuity that enables an individual to purchase an income stream that will begin at a later date.

Defined benefit A retirement plan in which a plan sponsor commits to paying a specified retirement benefit.

Defined contribution A retirement plan in which contributions are defined but the ultimate retirement benefit is not specified or guaranteed by the plan sponsor.

Delay cost The (trading related) cost associated with not submitting the order to the market in a timely manner.

Delta The change in an option's price in response to a change in price of the underlying, all else equal.

Delta hedging Hedging that involves matching the price response of the position being hedged over a narrow range of prices.

Demand deposits Accounts that can be drawn upon regularly and without notice. This category includes checking accounts and certain savings accounts that are often accessible through online banks or automated teller machines (ATMs).

Diffusion index An index that measures how many indicators are pointing up and how many are pointing down.

Direct market access (DMA) Access in which market participants can transact orders directly with the order book of an exchange using a broker's exchange connectivity.

Disability income insurance A type of insurance designed to mitigate earnings risk as a result of a disability in which an individual becomes less than fully employed.

Discretionary portfolio management An arrangement in which a wealth manager has a client's pre-approval to execute investment decisions.

Discretionary trust A trust structure in which the trustee determines whether and how much to distribute in the sole discretion of the trustee.

Dispersion The weighted *variance* of the times to receipt of cash flow; it measures the extent to which the payments are spread out around the duration.

Disposition effect As a result of loss aversion, an emotional bias whereby investors are reluctant to dispose of losers. This results in an inefficient and gradual adjustment to deterioration in fundamental value.

Dividend capture A trading strategy whereby an equity portfolio manager purchases stocks just before their ex-dividend dates, holds these stocks through the ex-dividend date to earn the right to receive the dividend, and subsequently sells the shares.

Domestic asset An asset that trades in the investor's domestic currency (or home currency).

Domestic currency The currency of the investor, i.e., the currency in which he or she typically makes consumption purchases, e.g., the Swiss franc for an investor domiciled in Switzerland.

Domestic-currency return A rate of return stated in domestic currency terms from the perspective of the investor; reflects both the foreign-currency return on an asset as well as percentage movement in the spot exchange rate between the domestic and foreign currencies.

Donor-advised fund A fund administered by a tax-exempt entity in which the donor advises on where to grant the money that he or she has donated.

Double inflection utility function A utility function that changes based on levels of wealth.

Downside capture ratio A measure of capture when the benchmark return is negative in a given period; downside capture less (greater) than 100% generally suggests out (under) performance relative to the benchmark.

Drawdown A decline in value (represented by a series of negative returns only) following a peak fund valuation.

Due diligence Investigation and analysis in support of an investment action, decision, or recommendation.

Duration matching Immunization approach based on the duration of assets and liabilities. Ideally, the liabilities being matched (the liability portfolio) and the portfolio of assets (the bond portfolio) should be affected similarly by a change in interest rates.

Dynamic asset allocation A strategy incorporating deviations from the strategic asset allocation that are motivated by longer-term valuation signals or economic views than usually associated with tactical asset allocation.

Dynamic hedge A hedge requiring adjustment as the price of the hedged asset changes.

Earnings risk The risk associated with the earning potential of an individual.

Econometrics The application of quantitative modeling and analysis grounded in economic theory to the analysis of economic data.

Economic balance sheet A balance sheet that provides an individual's total wealth portfolio, supplementing traditional balance sheet assets with human capital and pension wealth, and expanding liabilities to include consumption and bequest goals. Also known as *holistic balance sheet*.

Economic indicators Economic statistics provided by government and established private organizations that contain information on an economy's recent past activity or its current or future position in the business cycle.

Economic net worth The difference between an individual's assets and liabilities; extends traditional financial assets and liabilities to include human capital and future consumption needs.

Effective convexity A second-order effect that describes how a bond's interest rate sensitivity changes with changes in yield. Effective convexity is used when the bond has cash flows that change when yields change (as in the case of callable bonds or mortgage-backed securities).

Effective duration Duration adjusted to account for embedded options.

Effective federal funds (FFE) rate The fed funds rate actually transacted between depository institutions, not the Fed's target federal funds rate.

Emotional biases Behavioral biases resulting from reasoning influenced by feelings; emotional biases stem from impulse or intuition.

Empirical duration A measure of interest rate sensitivity that is determined from market data.

Endowment bias An emotional bias in which people value an asset more when they hold rights to it than when they do not.

Endowment model Characterized by a high allocation to alternative investments (private investments and hedge funds), significant active management, and externally managed assets.

Enhanced indexing strategy Method investors use to match an underlying market index in which the investor purchases fewer securities than the full set of index constituents but matches primary risk factors reflected in the index.

Environmental, social, and corporate governance (ESG) Also called socially responsible investing, refers to the explicit inclusion of ethical, environmental, or social criteria when selecting a portfolio.

Equity forward sale contract A private contract for the forward sale of an equity position.

Equity monetization The realization of cash for an equity position through a manner other than an outright sale.

Estate All of the property a person owns or controls; may consist of financial assets, tangible personal assets, immovable property, or intellectual property.

Estate planning The process of preparing for the disposition of one's estate (e.g., the transfer of property) upon death and during one's lifetime.

Estate tax freeze A plan usually involving a corporation, partnership, or limited liability company with the goal to transfer *future* appreciation to the next generation at little or no gift or estate tax cost.

Ethical principles Beliefs regarding what is good, acceptable, or obligatory behavior and what is bad, unacceptable, or forbidden behavior.

Evaluated pricing See *matrix pricing*.

Excess capital An investor's capital over and above that which is necessary to fund their lifestyle and reserves.

Excess return Used in various senses appropriate to context: 1) The difference between the portfolio return and the benchmark return; 2) The return in excess of the risk-free rate.

Exchange-traded fund Exchange-traded Funds or ETFs are hybrid investment products with many features of mutual funds combined with the trading features of common

- stocks or bonds.** Essentially, ETFs are typically portfolios of stocks or bonds or commodities that trade throughout the day like common stocks.
- Execution cost** The difference between the (trading related) cost of the real portfolio and the paper portfolio, based on shares and prices transacted.
- Exemption method** When the residence country imposes no tax on foreign-source income by providing taxpayers with an exemption, in effect having only one jurisdiction impose tax.
- Exhaustive** An index construction strategy that selects every constituent of a universe.
- Expected shortfall** The average loss conditional on exceeding the VaR cutoff; sometimes referred to as *conditional VaR* or *expected tail loss*.
- Expected tail loss** See *expected shortfall*.
- Extended portfolio assets and liabilities** Assets and liabilities beyond those shown on a conventional balance sheet that are relevant in making asset allocation decisions; an example of an extended asset is human capital.
- Factor-model-based benchmarks** Benchmarks constructed by examining a portfolio's sensitivity to a set of factors, such as the return for a broad market index, company earnings growth, industry, or financial leverage.
- Fiduciary duty** The obligation to act in the best interest of the client, exercising a reasonable level of care, skill, and diligence.
- Financial buyers** Buyers who lack a strategic motive.
- Financial capital** The tangible and intangible assets (excluding human capital) owned by an individual or household.
- Fixed trust** A trust structure in which distributions to beneficiaries are prescribed in the trust document to occur at certain times or in certain amounts.
- Forced heirship rules** Legal ownership principles whereby children have the right to a fixed share of a parent's estate.
- Foreign assets** Assets denominated in currencies other than the investor's home currency.
- Foreign currency** Currency that is not the currency in which an investor makes consumption purchases, e.g., the US dollar from the perspective of a Swiss investor.
- Foreign-currency return** The return of the foreign asset measured in foreign-currency terms.
- Forward conversion with options** The construction of a synthetic short forward position against the asset held long.
- Forward rate bias** Persistent violation of uncovered interest rate parity that is exploited by the carry trade.
- Framing** An information-processing bias in which a person answers a question differently based on the way in which it is asked (framed).
- Framing bias** An information-processing bias in which a person answers a question differently based on the way in which it is asked (framed).
- Fulcrum securities** Partially-in-the-money claims (not expected to be repaid in full) whose holders end up owning the reorganized company in a corporate reorganization situation.
- Full replication approach** When every issue in an index is represented in the portfolio, and each portfolio position has approximately the same weight in the fund as in the index.
- Fund-of-funds** A fund of hedge funds in which the fund-of-funds manager allocates capital to separate, underlying hedge funds (e.g., single manager and/or multi-manager funds) that themselves run a range of different strategies.
- Funding currencies** The low-yield currencies in which borrowing occurs in a carry trade.
- G-spread** The yield on a credit security over the yield of an actual or interpolated government bond.
- Gamblers' fallacy** A misunderstanding of probabilities in which people wrongly project reversal to a long-term mean.
- Gamma** The change in an option's delta for a change in price of the underlying, all else equal.
- General account** Account holding assets to fund future liabilities from traditional life insurance and fixed annuities, the products in which the insurer bears all the risks—particularly mortality risk and longevity risk.
- Goals-based** With respect to asset allocation or investing, an approach that focuses on achieving an investor's goals (for example, related to supporting lifestyle needs or aspirations) based typically on constructing sub-portfolios aligned with those goals.
- Goals-based investing** An investment industry term for approaches to investing for individuals and families focused on aligning investments with goals (parallel to liability-driven investing for institutional investors).
- Grinold-Kroner model** An expression for the expected return on a share as the sum of an expected income return, an expected nominal earnings growth return, and an expected repricing return.
- Hague Conference on Private International Law** An inter-governmental organization working toward the convergence of private international law. Its 69 members consist of countries and regional economic integration organizations.
- Halo effect** An emotional bias that extends a favorable evaluation of some characteristics to other characteristics.
- Hard-catalyst event-driven approach** An event-driven approach in which investments are made in reaction to an already announced corporate event (mergers and acquisitions, bankruptcies, share issuances, buybacks, capital restructurings, re-organizations, accounting changes) in which security prices related to the event have yet to fully converge.
- Health insurance** A type of insurance used to cover health care and medical costs.
- Health risk** The risk associated with illness or injury.
- Hedge ratio** The relationship of the quantity of an asset being hedged to the quantity of the derivative used for hedging.
- Herding** When a group of investors trade on the same side of the market in the same securities, or when investors ignore their own private information and act as other investors do.
- High-water mark** A specified net asset value level that a fund must exceed before performance fees are paid to the hedge fund manager.
- Hindsight bias** A bias with selective perception and retention aspects in which people may see past events as having been predictable and reasonable to expect.
- Holdings-based attribution** A "buy and hold" attribution approach which calculates the return of portfolio and benchmark components based upon the price and foreign exchange rate changes applied to daily snapshots of portfolio holdings.
- Holdings-based style analysis** A bottom-up style analysis that estimates the risk exposures from the actual securities held in the portfolio at a point in time.
- Holistic balance sheet** See *economic balance sheet*.
- Home bias** A preference for securities listed on the exchanges of one's home country.

Home-country bias The favoring of domestic over non-domestic investments relative to global market value weights.

Home currency See *domestic currency*.

Horizon matching Hybrid approach that combines cash flow and duration matching approaches. Under this approach, liabilities are categorized as short-and long-term liabilities.

Human capital An implied asset; the net present value of an investor's future expected labor income weighted by the probability of surviving to each future age. Also called *net employment capital*.

I-spread The yield on a credit security over the swap rate (denominated in the same currency as the credit security). Also known as interpolated spread.

Illusion of control A bias in which people tend to believe that they can control or influence outcomes when, in fact, they cannot. Illusion of knowledge and self-attribution biases contribute to the overconfidence bias.

Illusion of control bias A bias in which people tend to believe that they can control or influence outcomes when, in fact, they cannot. Illusion of knowledge and self-attribution biases contribute to the overconfidence bias.

Immediate annuity An annuity that provides a guarantee of specified future monthly payments over a specified period of time.

Immunization An asset/liability management approach that structures investments in bonds to match (offset) liabilities' weighted-average duration; a type of dedication strategy.

Impact investing Investment approach that seeks to achieve targeted social or environmental objectives along with measurable financial returns through engagement with a company or by direct investment in projects or companies.

Implementation shortfall (IS) The difference between the return for a notional or paper portfolio, where all transactions are assumed to take place at the manager's decision price, and the portfolio's actual return, which reflects realized transactions, including all fees and costs.

Implied volatility The outlook for the future volatility of the underlying asset's price. It is the value (i.e., standard deviation of underlying's returns) that equates the model (e.g., Black–Scholes–Merton model) price of an option to its market price.

Implied volatility surface A three-dimensional plot, for put and call options on the same underlying asset, of days to expiration (x -axis), option strike prices (y -axis), and implied volatilities (z -axis). It simultaneously shows the volatility skew (or smile) and the term structure of implied volatility.

Indexing A common passive approach to investing that involves holding a portfolio of securities designed to replicate the returns on a specified index of securities.

Indifference curve analysis A decision-making approach whereby curves of consumption bundles, among which the decision-maker is indifferent, are constructed to identify and choose the curve within budget constraints that generates the highest utility.

Information coefficient Formally defined as the correlation between forecast return and actual return. In essence, it measures the effectiveness of investment insight.

Input uncertainty Uncertainty concerning whether the inputs are correct.

Interaction effect The attribution effect resulting from the interaction of the allocation and selection decisions.

Intertemporal consistency A feature of expectations setting which means that estimates for an asset class over different horizons reflect the same assumptions with respect to the potential paths of returns over time. It is the internal consistency over various time horizons.

Intestate Having made no valid will; a decedent without a valid will or with a will that does not dispose of their property is considered to have died intestate.

Intrinsic value The difference between the spot exchange rate and the strike price of a currency option.

Investment currencies The high-yielding currencies in a carry trade.

Investment policy statement A written planning document that describes a client's investment objectives and risk tolerance over a relevant time horizon, along with the constraints that apply to the client's portfolio.

Investment style A natural grouping of investment disciplines that has some predictive power in explaining the future dispersion of returns across portfolios.

Irrevocable trust A trust arrangement wherein the settlor has no ability to revoke the trust relationship.

Joint ownership with right of survivorship Jointly owned; assets held in joint ownership with right of survivorship automatically transfer to the surviving joint owner or owners outside the probate process.

Key person risk The risk that results from over-reliance on an individual or individuals whose departure would negatively affect an investment manager.

Key rate duration A method of measuring the interest rate sensitivities of a fixed-income instrument or portfolio to shifts in key points along the yield curve.

Knock-in/knock-out Features of a vanilla option that is created (or ceases to exist) when the spot exchange rate touches a pre-specified level.

Leading economic indicators A set of economic variables whose values vary with the business cycle but at a fairly consistent time interval before a turn in the business cycle.

Leveraged recapitalization A leveraging of a company's balance sheet, usually accomplished by working with a private equity firm.

Liability-driven investing An investment industry term that generally encompasses asset allocation that is focused on funding an investor's liabilities in institutional contexts.

Liability driven investing (LDI) model In the LDI model, the primary investment objective is to generate returns sufficient to cover liabilities, with a focus on maximizing expected surplus return (excess return of assets over liabilities) and managing surplus volatility.

Liability glide path A specification of desired proportions of liability-hedging assets and return-seeking assets and the duration of the liability hedge as funded status changes and contributions are made.

Liability insurance A type of insurance used to manage liability risk.

Liability-relative With respect to asset allocation, an approach that focuses directly only on funding liabilities as an investment objective.

Liability risk The possibility that an individual or household may be held legally liable for the financial costs associated with property damage or physical injury.

Life-cycle finance A concept in finance that recognizes as an investor ages, the fundamental nature of wealth and risk evolves.

- Life insurance** A type of insurance that protects against the loss of human capital for those who depend on an individual's future earnings.
- Life settlement** The sale of a life insurance contract to a third party. The valuation of a life settlement typically requires detailed biometric analysis of the individual policyholder and an understanding of actuarial analysis.
- Lifetime gratuitous transfer** A lifetime gift made during the lifetime of the donor; also known as *inter vivos* transfers.
- Limited-life foundations** A type of foundation where founders seek to maintain control of spending while they (or their immediate heirs) are still alive.
- Liquidity budget** The portfolio allocations (or weightings) considered acceptable for the liquidity categories in the liquidity classification schedule (or time-to-cash table).
- Liquidity classification schedule** A liquidity management classification (or table) that defines portfolio liquidity "buckets" or categories based on the estimated time it would take to convert assets in that particular category into cash.
- Longevity risk** The risk associated with living to an advanced age in retirement, including the uncertainty surrounding how long retirement will last; the risk of outliving one's financial resources.
- Loss-aversion bias** A bias in which people tend to strongly prefer avoiding losses as opposed to achieving gains.
- Loss given default** See *loss severity*.
- Loss severity** The amount of loss if a default occurs. Also called *loss given default*.
- Macaulay duration** The percentage change in price for a percentage change in yield. The term, named for one of the economists who first derived it, is used to distinguish the calculation from modified duration. (See also *modified duration*).
- Macro attribution** Attribution at the sponsor level.
- Manager peer group** See *manager universe*.
- Manager universe** A broad group of managers with similar investment disciplines. Also called *manager peer group*.
- Market risk bucket** In goal-based portfolio planning, that part of wealth allocated to investments intended to maintain the client's current standard of living.
- Matrix pricing** An approach for estimating the prices of thinly traded securities based on the prices of securities with similar attributions, such as similar credit rating, maturity, or economic sector. Also called *evaluated pricing*.
- Mental accounting bias** An information-processing bias in which people treat one sum of money differently from another equal-sized sum based on which mental account the money is assigned to.
- Micro attribution** Attribution at the portfolio manager level.
- Minimum-variance hedge ratio** A mathematical approach to determining the optimal cross hedging ratio.
- Mismatch in character** The potential tax inefficiency that can result if the instrument being hedged, and the tool that is being used to hedge it, produce income and loss of a different character.
- Mission-related investing** Aims to direct a significant portion of assets in excess of annual grants into projects promoting a foundation's mission.
- Model uncertainty** Uncertainty as to whether a selected model is correct.
- Modified duration** An adjustment of the duration for the level of the yield. Contrast with *Macaulay duration*.
- Monetize** To access an item's cash value without transferring ownership of it.
- Money duration** A measure of the price change in units of the currency in which the bond is denominated given a change in its yield-to-maturity.
- Mortality table** A table that indicates individual life expectancies at specified ages.
- Multi-class trading** An equity market-neutral strategy that capitalizes on misalignment in prices and involves buying and selling different classes of shares of the same company, such as voting and non-voting shares.
- Multi-manager fund** Can be of two types—one is a multi-strategy fund in which teams of portfolio managers trade and invest in multiple different strategies within the same fund; the second type is a fund of hedge funds (or fund-of-funds) in which the manager allocates capital to separate, underlying hedge funds that themselves run a range of different strategies.
- Multi-strategy fund** A fund in which teams of portfolio managers trade and invest in multiple different strategies within the same fund.
- Multilateral trading facilities** (MTF) See *Alternative trading systems (ATS)*.
- Mutual funds** A professionally managed investment pool in which investors in the fund typically each have a pro-rata claim on the income and value of the fund.
- Negative screening** An ESG implementation approach that excludes certain sectors or companies that deviate from an investor's accepted standards.
- Net asset value** Value established at the end of each trading day based on the fund's valuation of all existing assets minus liabilities, divided by the total number of shares outstanding.
- Net employment capital** See *human capital*.
- Net worth tax or net wealth tax** A tax based on a person's assets, less liabilities.
- Non-deliverable forwards** Forward contracts that are cash settled (in the non-controlled currency of the currency pair) rather than physically settled (the controlled currency is neither delivered nor received).
- Nonstationarity** A characteristic of series of data whose properties, such as mean and variance, are not constant through time. When analyzing historical data it means that different parts of a data series reflect different underlying statistical properties.
- Norway model** Characterized by an almost exclusive reliance on public equities and fixed income (the traditional 60/40 equity/bond model falls under the Norway model), with largely passively managed assets and with very little to no allocation to alternative investments.
- Offer price** The price at which a counterparty is willing to sell one unit of the base currency.
- Opportunity cost** The (trading related) cost associated with not being able to transact the entire order at the decision price.
- Option-adjusted spread** The 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.
- Optional stock dividends** A type of dividend in which shareholders may elect to receive either cash or new shares.
- Overbought** When a market has trended too far in one direction and is vulnerable to a trend reversal, or correction.

Overconfidence bias A bias in which people demonstrate unwarranted faith in their own intuitive reasoning, judgments, and/or cognitive abilities.

Overlay A derivative position (or positions) used to adjust a pre-existing portfolio closer to its objectives.

Oversold The opposite of overbought; see *overbought*.

Packeting Splitting stock positions into multiple parts.

Pairs trading An equity market-neutral strategy that capitalizes on the misalignment in prices of pairs of similar under- and overvalued equities. The expectation is the differential valuations or trading relationships will revert to their long-term mean values or their fundamentally-correct trading relationships, with the long position rising and the short position declining in value.

Parameter uncertainty Uncertainty arising because a quantitative model's parameters are estimated with error.

Participant/cohort option Pools the DC plan member with a cohort that has a similar target retirement date.

Participant-switching life-cycle options Automatically switch DC plan members into a more conservative asset mix as their age increases. There may be several automatic de-risking switches at different age targets.

Passive investment Investment that seeks to mimic the prevailing characteristics of the overall investments available in terms of credit quality, type of borrower, maturity, and duration rather than express a specific market view.

Passive management A buy-and-hold approach to investing in which an investor does not make portfolio changes based upon short-term expectations of changing market or security performance.

Percent-range rebalancing An approach to rebalancing that involves setting rebalancing thresholds or trigger points, stated as a percentage of the portfolio's value, around target values.

Performance attribution Attribution, including return attribution and risk attribution; often used as a synonym for return attribution.

Permanent life insurance A type of life insurance that provides lifetime coverage.

Personal risk bucket In goal-based portfolio planning, that part of wealth allocated to investments intended to protect the client from a drastic decrease in lifestyle.

Portfolio overlay An array of derivative positions managed separately from the securities portfolio to achieve overall intended portfolio characteristics.

Position delta The overall or portfolio delta. For example, the position delta of a covered call, consisting of long 100 shares and short one at-the-money call, is +50 (= +100 for the shares and -50 for the short ATM call).

Positive screening An ESG implementation approach that seeks to identify the most favorable companies and sectors based on ESG considerations. Also called *best-in-class*.

Premature death risk The risk of an individual dying earlier than anticipated; sometimes referred to as *mortality risk*.

Premium Regarding life insurance, the asset paid by the policy holder to an insurer who, in turn, has a contractual obligation to pay death benefit proceeds to the beneficiary named in the policy.

Prepaid variable forward A collar and loan combined within a single instrument.

Present value of distribution of cash flows methodology Method used to address a portfolio's sensitivity to rate changes along the yield curve, this approach seeks to approximate and match the yield curve risk of an index over discrete time periods.

Price value of a basis point (PVBP) The change in the bond price for a 1 basis point change in yield. Also called *basis point value* (BPV).

Primary capital Assets held outside a concentrated position that are at least sufficient to provide for the owner's lifetime spending needs.

Principal trade A trade in which the market maker or dealer becomes a disclosed counterparty and assumes risk for the trade by transacting the security for their own account. Also called *broker risk trades*.

Probate The legal process to confirm the validity of a will so that executors, heirs, and other interested parties can rely on its authenticity.

Profession An occupational group that has specific education, expert knowledge, and a framework of practice and behavior that underpins community trust, respect, and recognition.

Program trading A strategy of buying or selling many stocks simultaneously.

Property insurance A type of insurance used by individuals to manage property risk.

Property risk The possibility that a person's property may be damaged, destroyed, stolen, or lost.

Prospect theory An alternative to expected utility theory, it assigns value to gains and losses (changes in wealth) rather than to final wealth, and probabilities are replaced by decision weights. In prospect theory, the shape of a decision maker's value function is assumed to differ between the domain of gains and the domain of losses.

Protective put An option strategy in which a long position in an asset is combined with a long position in a put on that asset.

Pure indexing Method investors use to match an underlying market index in which the investor aims to replicate an existing market index by purchasing all of the constituent securities in the index to minimize tracking risk.

Put spread A strategy used to reduce the upfront cost of buying a protective put, it involves buying a put option and writing another put option.

Quantitative market-neutral An approach to building market-neutral portfolios in which large numbers of securities are traded and positions are adjusted on a daily or even an hourly basis using algorithm-based models.

Rational economic man A self-interested, risk-averse individual who has the ability to make judgments using all available information in order to maximize his/her expected utility.

Re-base With reference to index construction, to change the time period used as the base of the index.

Realized volatility Historical volatility, the square root of the realized variance of returns, which is a measure of the range of past price outcomes for the underlying asset.

Rebalancing In the context of asset allocation, a discipline for adjusting the portfolio to align with the strategic asset allocation.

Rebalancing overlay A type of overlay that addresses a portfolio's need to sell certain constituent securities and buy others.

Rebalancing range A range of values for asset class weights defined by trigger points above and below target weights, such that if the portfolio value passes through a trigger point, rebalancing occurs. Also known as a corridor.

Rebate rate The portion of the collateral earnings rate that is repaid to the security borrower by the security lender.

Reduced-form models Models that use economic theory and other factors such as prior research output to describe hypothesized relationships. Can be described as more compact representations of underlying structural models. Evaluate endogenous variables in terms of observable exogenous variables.

Regime The governing set of relationships (between variables) that stem from technological, political, legal, and regulatory environments. Changes in such environments or policy stances can be described as changes in regime.

Regret The feeling that an opportunity has been missed; typically an expression of *hindsight bias*.

Regret-aversion bias An emotional bias in which people tend to avoid making decisions that will result in action out of fear that the decision will turn out poorly.

Relative value volatility arbitrage A volatility trading strategy that aims to source and buy cheap volatility and sell more expensive volatility while netting out the time decay aspects normally associated with options portfolios.

Repo rate The interest rate on a repurchase agreement.

Representativeness bias A belief perseverance bias in which people tend to classify new information based on past experiences and classifications.

Repurchase agreements (repos) In a repurchase agreement, a security owner agrees to sell a security for a specific cash amount, while simultaneously agreeing to repurchase the security at a specified future date (typically one day later) and price.

Request for quote (RFQ) A non-binding quote provided by a market maker or dealer to a potential buyer or seller upon request. Commonly used in fixed income markets these quotes are only valid at the time they are provided.

Reserve portfolio The component of an insurer's general account that is subject to specific regulatory requirements and is intended to ensure the company's ability to meet its policy liabilities. The assets in the reserve portfolio are managed conservatively and must be highly liquid and low risk.

Residence jurisdiction A framework used by a country to determine the basis for taxing income, based on residency.

Residence–residence conflict When two countries claim residence of the same individual, subjecting the individual's income to taxation by both countries.

Residence–source conflict When tax jurisdiction is claimed by an individual's country of residence and the country where some of their assets are sourced; the most common source of double taxation.

Resistance levels Price points on dealers' order boards where one would expect to see a clustering of offers.

Return attribution A set of techniques used to identify the sources of the excess return of a portfolio against its benchmark.

Returns-based attribution An attribution approach that uses only the total portfolio returns over a period to identify the components of the investment process that have generated the returns. The Brinson–Hood–Beebower approach is a returns-based attribution approach.

Returns-based benchmarks Benchmarks constructed by examining a portfolio's sensitivity to a set of factors, such as the returns for various style indexes (e.g., small-cap value, small-cap growth, large-cap value, and large-cap growth).

Returns-based style analysis A top-down style analysis that involves estimating the sensitivities of a portfolio to security market indexes.

Reverse repos Repurchase agreement from the standpoint of the lender.

Revocable trust A trust arrangement wherein the settlor (who originally transfers assets to fund the trust) retains the right to rescind the trust relationship and regain title to the trust assets.

Risk attribution The analysis of the sources of risk.

Risk aversion The degree of an investor's unwillingness to take risk; the inverse of risk tolerance.

Risk budgeting The establishment of objectives for individuals, groups, or divisions of an organization that takes into account the allocation of an acceptable level of risk.

Risk capacity The ability to accept financial risk.

Risk perception The subjective assessment of the risk involved in the outcome of an investment decision.

Risk premium An extra return expected by investors for bearing some specified risk.

Risk reversal A strategy used to profit from the existence of an implied volatility skew and from changes in its shape over time. A combination of long (short) calls and short (long) puts on the same underlying with the same expiration is a long (short) risk reversal.

Risk tolerance The capacity to accept risk; the level of risk an investor (or organization) is willing and able to bear.

Sale and leaseback A transaction wherein the owner of a property sells that property and then immediately leases it back from the buyer at a rate and term acceptable to the new owner and on financial terms consistent with the marketplace.

Sample-size neglect A type of representativeness bias in which financial market participants incorrectly assume that small sample sizes are representative of populations (or "real" data).

Satisfice A combination of "satisfy" and "suffice" describing decisions, actions, and outcomes that may not be optimal, but are adequate.

Scenario analysis A risk assessment technique involving the examination of the performance of a portfolio under specified situations.

Seagull spread An extension of the risk reversal foreign exchange option strategy that limits downside risk.

Securities lending A form of collateralized lending that may be used to generate income for portfolios.

Selective An index construction methodology that targets only those securities with certain characteristics.

Self-attribution bias A bias in which people take personal credit for successes and attribute failures to external factors outside the individual's control.

Self-control bias A bias in which people fail to act in pursuit of their long-term, overarching goals because of a lack of self-discipline.

Separate accounts Accounts holding assets to fund future liabilities from variable life insurance and variable annuities, the products in which customers make investment decisions from a menu of options and themselves bear investment risk.

Separate property regime A marital property regime under which each spouse is able to own and control property as an individual.

Settlor (or grantor) An entity that transfers assets to a trustee, to be held and managed for the benefit of the trust beneficiaries.

Shari'a The law of Islam. In addition to the law of the land, some follow guidance provided by Shari'a or Islamic law.

Sharpe ratio The average return in excess of the risk-free rate divided by the standard deviation of return; a measure of the average excess return earned per unit of standard deviation of return. Also known as the *reward-to-variability ratio*.

Short-biased A hedge fund strategy in which the manager uses a less extreme version of dedicated short-selling. It involves searching for opportunities to sell expensively priced equities, but short exposure may be balanced with some modest value-oriented, or index-oriented, long exposure.

Short sale against the box Shorting a security that is held long.

Shortfall probability The probability of failing to meet a specific liability or goal.

Shrinkage estimation Estimation that involves taking a weighted average of a historical estimate of a parameter and some other parameter estimate, where the weights reflect the analyst's relative belief in the estimates.

Single-manager fund A fund in which one portfolio manager or team of portfolio managers invests in one strategy or style.

Situational influences External factors, such as environmental or cultural elements, that shape our behavior.

Smart beta Involves the use of simple, transparent, rules-based strategies as a basis for investment decisions.

Smart order routers (SOR) Smart systems used to electronically route small orders to the best markets for execution based on order type and prevailing market conditions.

Social proof A bias in which individuals tend to follow the beliefs of a group.

Soft-catalyst event-driven approach An event-driven approach in which investments are made proactively in anticipation of a corporate event (mergers and acquisitions, bankruptcies, share issuances, buybacks, capital restructurings, re-organizations, accounting changes) that has yet to occur.

Sole ownership Owned by one person; assets held in sole ownership are typically considered part of a decedent's estate. The transfer of their ownership is dictated by the decedent's will through the probate process.

Source jurisdiction A framework used by a country to determine the basis for taxing income or transfers. A country that taxes income as a source within its borders imposes source jurisdiction.

Source-source conflict When two countries claim source jurisdiction of the same asset; both countries may claim that the income is derived from their jurisdiction.

Special dividends 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.

Spread curve The fitted curve of credit spreads for each bond of an issuer plotted against either the maturity or duration of each of those bonds.

Spread duration A measure used in determining a portfolio's sensitivity to changes in credit spreads.

Standards of conduct Behaviors required by a group; established benchmarks that clarify or enhance a group's code of ethics.

Static hedge A hedge that is not sensitive to changes in the price of the asset hedged.

Status quo bias An emotional bias in which people do nothing (i.e., maintain the "status quo") instead of making a change.

Stock lending Securities lending involving the transfer of equities.

Stop-losses A trading order that sets a selling price below the current market price with a goal of protecting profits or preventing further losses.

Stops Stop-loss orders involve leaving bids or offers away from the current market price to be filled if the market reaches those levels.

Straddle An option combination in which one buys *both* puts and calls, with the same exercise price and same expiration date, on the same underlying asset. In contrast to this long straddle, if someone *writes* both options, it is a short straddle.

Strangle A variation on a straddle in which the put and call have different exercise prices; if the put and call are held long, it is a long strangle; if they are held short, it is a short strangle.

Strategic asset allocation 1) The process of allocating money to IPS-permissible asset classes that integrates the investor's return objectives, risk tolerance, and investment constraints with long-run capital market expectations. 2) The result of the above process, also known as the policy portfolio.

Strategic buyers Buyers who have a strategic motive (e.g., realization of synergies) for seeking to buy a company.

Stratified sampling A sampling method that guarantees that subpopulations of interest are represented in the sample. Also called *representative sampling* or *cell approach*.

Structural models Models that specify functional relationships among variables based on economic theory. The functional form and parameters of these models are derived from the underlying theory. They may include unobservable parameters.

Structural risk Risk that arises from portfolio design, particularly the choice of the portfolio allocations.

Stub trading An equity market-neutral strategy that capitalizes on misalignment in prices and entails buying and selling stock of a parent company and its subsidiaries, typically weighted by the percentage ownership of the parent company in the subsidiaries.

Support levels Price points on dealers' order boards where one would expect to see a clustering of bids.

Surplus The difference between the value of assets and the present value of liabilities. With respect to an insurance company, the net difference between the total assets and total liabilities (equivalent to policyholders' surplus for a mutual insurance company and stockholders' equity for a stock company).

Surplus capital Capital that is in excess of primary capital.

Surplus portfolio The component of an insurer's general account that is intended to realize higher expected returns than the reserve portfolio and so can assume some liquidity risk. Surplus portfolio assets are often managed aggressively with exposure to alternative assets.

Survival probability The probability an individual survives in a given year; used to determine expected cash flow required in retirement.

Survivorship bias Bias that arises in a data series when managers with poor track records exit the business and are dropped from the database whereas managers with good records remain; when a data series of a given date reflects only entities that have survived to that date.

Synthetic long forward position The combination of a long call and a short put with identical strike price and expiration, traded at the same time on the same underlying.

Synthetic short forward position The combination of a short call and a long put at the same strike price and maturity (traded at the same time on the same underlying).

Tactical asset allocation Asset allocation that involves making short-term adjustments to asset class weights based on short-term predictions of relative performance among asset classes.

Tail risk The risk that there are more actual events in the tail of a probability distribution than would be predicted by probability models.

Tax avoidance Developing strategies that minimize tax, while conforming to both the spirit and the letter of the tax codes of jurisdictions with taxing authority.

Tax evasion The practice of circumventing tax obligations by illegal means such as misreporting or not reporting relevant information to tax authorities.

Taylor rule A rule linking a central bank's target short-term interest rate to the rate of growth of the economy and inflation.

Temporary life insurance A type of life insurance that covers a certain period of time, specified at purchase. Commonly referred to as "term" life insurance.

Term deposits Interest-bearing accounts that have a specified maturity date. This category includes savings accounts and certificates of deposit (CDs).

Term structure of volatility The plot of implied volatility (y -axis) against option maturity (x -axis) for options with the same strike price on the same underlying. Typically, implied volatility is not constant across different maturities – rather, it is often in contango, meaning that the implied volatilities for longer-term options are higher than for near-term ones.

Territorial tax system A framework used by a country to determine the basis for taxing income or transfers. A country that taxes income as a source within its borders imposes source jurisdiction.

Testamentary gratuitous transfer The bequeathing or transfer of assets upon one's death. From a recipient's perspective, it is called an inheritance.

Testator A person who makes a will.

Thematic investing An investment approach that focuses on companies within a specific sector or following a specific theme, such as energy efficiency or climate change.

Theta The daily change in an option's price, all else equal. Theta measures the sensitivity of the option's price to the passage of time, known as time decay.

Time deposits Interest-bearing accounts that have a specified maturity date. This category includes savings accounts and certificates of deposit (CDs).

Time-series estimation Estimators that are based on lagged values of the variable being forecast; often consist of lagged values of other selected variables.

Time-series momentum A managed futures trend following strategy in which managers go long assets that are rising in price and go short assets that are falling in price. The manager trades on an absolute basis, so be net long or net

short depending on the current price trend of an asset. This approach works best when an asset's own past returns are a good predictor of its future returns.

Time-to-cash table See *liquidity classification schedule*.

Time value The difference between the market price of an option and its intrinsic value, determined by the uncertainty of the underlying over the remaining life of the option.

Top-down approach A credit strategy approach that involves formulating a view on major macroeconomic trends and then selecting the bonds that the investor expects to perform best in the expected environment.

Total factor productivity A variable which accounts for that part of Y not directly accounted for by the levels of the production factors (K and L).

Total return equity swap A swap contract that involves a series of exchanges of the total return on a specified asset or equity index in return for specified fixed or floating rate payments.

Total return payer Party responsible for paying the reference obligation cash flows and return to the receiver, but will also be compensated by the receiver for any depreciation in the index or default losses incurred on the portfolio.

Total return receiver Party receives both the cash flows from the underlying index as well as any appreciation in the index over the period in exchange for paying Libor plus a pre-determined spread.

Total return swap A swap in which one party agrees to pay the total return on a security. Often used as a credit derivative, in which the underlying is a bond.

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*.

Trade urgency A reference to how quickly or slowly an order is executed over the trading time horizon.

Transactions-based attribution An attribution approach that captures the impact of intra-day trades and exogenous events such as a significant class action settlement.

Transfer coefficient The ability to translate portfolio insights into investment decisions without constraint.

Trigger points In the context of portfolio rebalancing, the endpoints of a rebalancing range (corridor).

Unsmoothing An adjustment to the reported return series if serial correlation is detected. Various approaches are available to unsmooth a return series.

Upside capture ratio A measure of capture when the benchmark return is positive in a given period; upside capture greater (less) than 100% generally suggests out (under) performance relative to the benchmark.

Utility The level of relative satisfaction received from the consumption of goods and services.

Utility theory Theory whereby people maximize the present value of utility subject to a present value budget constraint.

Variance notional The notional amount of a variance swap; it equals vega notional divided by two times the volatility strike price [i.e., $(\text{vega notional})/(2 \times \text{volatility strike})$].

Vega The change in an option's price for a change in volatility of the underlying, all else equal.

Vega notional The trade size for a variance swap, which represents the average profit and loss of the variance swap for a 1% change in volatility from the strike.

Vesting A term indicating that employees only become eligible to receive a pension after meeting certain criteria, typically a minimum number of years of service.

Volatility clustering The tendency for large (small) swings in prices to be followed by large (small) swings of random direction.

Volatility skew The skewed plot (of implied volatility (*y*-axis) against strike price (*x*-axis) for options on the same underlying with the same expiration) that occurs when the implied volatility increases for OTM puts and decreases for OTM calls, as the strike price moves away from the current price.

Volatility smile The U-shaped plot (of implied volatility (*y*-axis) against strike price (*x*-axis) for options on the same underlying with the same expiration) that occurs when the implied volatilities priced into both OTM puts and calls trade at a premium to implied volatilities of ATM options.

Will A document associated with estate planning that outlines the rights others will have over one's property after death. Also called *testament*.

Z-spread The yield spread that must be added to each point of the implied spot yield curve to make the present value of a bond's cash flows equal its current market price. Also known as zero-volatility spread.