

**2025 FRM<sup>®</sup>**  
Exam Prep

# SchweserNotes<sup>™</sup>

Risk Management and Investment Management  
& Current Issues in Financial Markets

**Part II** Book 5

**KAPLAN** SCHWESER

Book 5: Risk Management and Investment  
Management & Current Issues in Financial  
Markets

**SchweserNotes™ 2025**

FRM Part II

**KAPLAN**  **SCHWESER**

SCHWESERNOTES™ 2025 FRM® PART II BOOK 5: RISK MANAGEMENT AND INVESTMENT MANAGEMENT & CURRENT ISSUES IN FINANCIAL MARKETS

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Published in 2025 by Kaplan, Inc.

ISBN: 978-1-0788-4959-3

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# Readings and Learning Objectives

## STUDY SESSION 13

### 85. Factor Theory

**Andrew Ang, *Asset Management: A Systematic Approach to Factor Investing* (New York, NY: Oxford University Press, 2014). Chapter 6.**

After completing this reading, you should be able to:

- describe factors that impact asset prices and explain the theory of factor risk premiums.
- discuss the capital asset pricing model (CAPM) including its assumptions and explain how factor risk is addressed in the CAPM.
- explain the implications of using the CAPM to value assets, including equilibrium and optimal holdings, exposure to factor risk, its treatment of diversification benefits, and shortcomings of the CAPM.
- describe multifactor models and compare and contrast multifactor models to the CAPM.
- explain how stochastic discount factors are created and apply them in the valuation of assets.
- describe efficient market theory and explain how markets can be inefficient.

### 86. Factors

**Andrew Ang, *Asset Management: A Systematic Approach to Factor Investing* (New York, NY: Oxford University Press, 2014). Chapter 7.**

After completing this reading, you should be able to:

- describe the process of value investing and explain why a value premium may exist.
- explain how different macroeconomic risk factors, including economic growth, inflation, and volatility, affect asset returns and risk premiums.
- assess methods of mitigating volatility risk in a portfolio and describe challenges that arise when managing volatility risk.
- explain how dynamic risk factors can be used in a multifactor model of asset returns, using the Fama-French model as an example.
- compare value and momentum investment strategies, including their return and risk profiles.

### 87. Alpha (and the Low-Risk Anomaly)

**Andrew Ang, *Asset Management: A Systematic Approach to Factor Investing* (New York, NY: Oxford University Press, 2014). Chapter 10.**

After completing this reading, you should be able to:

- describe and evaluate the low-risk anomaly of asset returns.
- define and calculate alpha, tracking error, the information ratio, and the Sharpe ratio.
- explain the impact of benchmark choice on alpha and describe characteristics of an effective benchmark to measure alpha.
- describe Grinold's fundamental law of active management, including its assumptions and limitations, and calculate the maximum attainable information ratio using this law.
- apply a factor regression to construct a benchmark with multiple factors, measure a portfolio's sensitivity to those factors, and measure alpha against that benchmark.
- explain how to use style analysis to handle time-varying factor exposures.
- describe issues that arise when measuring alphas for nonlinear strategies.
- compare the volatility anomaly and the beta anomaly and analyze evidence of each anomaly.
- describe potential explanations for the risk anomaly.

### 88. Portfolio Construction

**Richard Grinold and Ronald Kahn, *Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk, 2nd Edition* (New York, NY: McGraw-Hill, 2000). Chapter 14.**

After completing this reading, you should be able to:

- describe the inputs to the portfolio construction process and explain challenges faced when using these inputs.

- b. evaluate the motivation for and the methods used for refining alphas in the implementation process.
- c. describe neutralization and the different approaches used for refining alphas to be neutral.
- d. explain the implications of transaction costs on portfolio construction.
- e. describe practical issues in portfolio construction, including the determination of an appropriate risk aversion, aversions to specific risks, and proper alpha coverage.
- f. describe portfolio revisions and rebalancing, and analyze the tradeoffs between alpha, risk, transaction costs, and time horizon.
- g. determine the optimal no-trade region for rebalancing with transaction costs.
- h. evaluate the strengths and weaknesses of the following portfolio construction techniques: screens, stratification, linear programming, and quadratic programming.
- i. describe dispersion, explain its causes, and describe methods for controlling forms of dispersion.

#### 89. Portfolio Risk: Analytical Methods

**Philippe Jorion, *Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition* (New York, NY: McGraw-Hill, 2007). Chapter 7.**

After completing this reading, you should be able to:

- a. define, calculate, and compare the following portfolio VaR measures: diversified and undiversified portfolio VaR, individual VaR, incremental VaR, marginal VaR, and component VaR.
- b. explain the impact of correlation on portfolio risk.
- c. apply the concept of marginal VaR in making portfolio management decisions.
- d. explain and calculate the risk-minimizing position and the position that maximizes the ratio of expected return to risk.
- e. explain the difference between risk management and portfolio management and describe how to use marginal VaR in portfolio management.

#### 90. VaR and Risk Budgeting in Investment Management

**Philippe Jorion, *Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition* (New York, NY: McGraw-Hill, 2007). Chapter 17.**

After completing this reading, you should be able to:

- a. define risk budgeting.
- b. describe the impact of horizon, turnover, and leverage on the risk management process in the investment management industry.
- c. describe the investment process of large investors such as pension funds.
- d. describe the risk management challenges associated with investments in hedge funds.
- e. describe and compare the following types of risk: absolute risk, relative risk, policy-mix risk, active management risk, funding risk, and sponsor risk.
- f. explain the use of VaR to monitor risk.
- g. explain how VaR can be used in the development of investment guidelines and for improving the investment process.
- h. describe the risk budgeting process and calculate risk budgets across asset classes and active managers.

## STUDY SESSION 14

#### 91. Risk Monitoring and Performance Measurement

**Robert Litterman and the Quantitative Resources Group, *Modern Investment Management: An Equilibrium Approach* (Hoboken, NJ: John Wiley & Sons, 2003). Chapter 17.**

After completing this reading, you should be able to:

- a. describe the three fundamental dimensions behind risk management, and their relation to VaR and tracking error.
- b. describe risk planning, including its objectives, effects, and the participants in its development.
- c. describe risk budgeting and the role of quantitative methods in risk budgeting.
- d. describe risk monitoring and its role in an internal control environment.
- e. identify sources of risk consciousness within an organization.
- f. describe the objectives and actions of a risk management unit in an investment management firm.
- g. explain how risk monitoring can confirm that investment activities are consistent with expectations.

- h. describe the Liquidity Duration Statistic and how it can be used to measure liquidity.
- i. describe the objectives of performance measurement tools.
- j. explain the use of alpha, benchmarks, and peer groups as inputs in performance measurement tools.

## 92. Portfolio Performance Evaluation

**Zvi Bodie, Alex Kane, and Alan J. Marcus, *Investments, 12th Edition* (New York, NY: McGraw-Hill, 2020). Chapter 24.**

After completing this reading, you should be able to:

- a. differentiate between the time-weighted and dollar-weighted returns of a portfolio and describe their appropriate uses.
- b. describe risk-adjusted performance measures, such as Sharpe's measure, Treynor's measure, Jensen's measure (Jensen's alpha), and the information ratio, and identify the circumstances under which the use of each measure is most relevant.
- c. describe the uses for the Modigliani-squared and Treynor's measure in comparing two portfolios and the graphical representation of these measures.
- d. determine the statistical significance of a performance measure using standard error and the t-statistic.
- e. describe style analysis.
- f. explain the difficulties in measuring the performance of actively managed portfolios.
- g. describe performance manipulation and the problems associated with using conventional performance measures.
- h. describe techniques to measure the market timing ability of fund managers with a regression and with a call option model and calculate a manager's return due to market timing.
- i. describe and apply performance attribution procedures, including the asset allocation decision, sector and security selection decision, and the aggregate contribution.

## 93. Hedge Funds

**George M. Constantinides, Milton Harris, and René M. Stulz, eds., *Handbook of the Economics of Finance, Volume 2B* (Oxford, UK: Elsevier, 2013). Chapter 17.**

After completing this reading, you should be able to:

- a. explain biases that are commonly found in databases of hedge funds.
- b. explain the evolution of the hedge fund industry and describe landmark events that precipitated major changes in the development of the industry.
- c. explain the impact of institutional investors on the hedge fund industry and assess reasons for the growing concentration of assets under management (AUM) in the industry.
- d. explain the relationship between risk and alpha in hedge funds.
- e. compare and contrast the different hedge fund strategies, describe their return characteristics, and describe the inherent risks of each strategy.
- f. describe the historical portfolio construction and performance trends of hedge funds compared to those of equity indices.
- g. describe market events that resulted in a convergence of risk factors for different hedge fund strategies and explain the impact of such convergences on portfolio diversification strategies.
- h. describe the problem of risk sharing asymmetry between principals and agents in the hedge fund industry.

## 94. Performing Due Diligence on Specific Managers and Funds

**Kevin R. Mirabile, *Hedge Fund Investing: A Practical Approach to Understanding Investor Motivation, Manager Profits, and Fund Performance, 2nd Edition* (Hoboken, NJ: Wiley Finance, 2016). Chapter 12.**

After completing this reading, you should be able to:

- a. identify reasons for the failures of hedge funds in the past.
- b. explain elements of the due diligence process used to assess investment managers.
- c. identify themes and questions investors can consider when evaluating a hedge fund manager.
- d. describe criteria that can be evaluated in assessing a hedge fund's risk management process.
- e. explain how due diligence can be performed on a hedge fund's operational environment.
- f. explain how a hedge fund's business model risk and its fraud risk can be assessed.
- g. describe elements that can be included as part of a due diligence questionnaire.

## 95. Predicting Fraud by Investment Managers

**Stephen G. Dimmock and William C. Gerken, "Predicting Fraud by Investment Managers,"**

*Journal of Financial Economics* 105, no. 1 (2012): 153–173.

After completing this reading, you should be able to:

- a. explain the use and efficacy of information disclosures made by investment advisors in predicting fraud.
- b. describe the barriers and the costs incurred in implementing fraud prediction methods.
- c. discuss ways to improve investors' ability to use disclosed data to predict fraud.

## STUDY SESSION 15

### 96. 2023 Bank Failures: Preliminary Lessons Learnt for Resolution

**"2023 Bank Failures, Preliminary lessons learnt for resolution," FSB, October 2023.**

After completing this reading, you should be able to:

- a. evaluate the Credit Suisse case and its implications for the international resolution framework.
- b. evaluate the US bank failures of 2023 and their implications for the international resolution framework.
- c. identify and describe the strengths and weaknesses of the resolution framework as demonstrated by Credit Suisse case and the US bank failures of 2023.
- d. describe the uncovered issues for bank resolution that require further studies and development for future improvements on the implementation of the international resolution framework.

### 97. Generative Artificial Intelligence in Finance: Risk Considerations

**"Generative Artificial Intelligence in Finance: Risk Considerations," IMF, August 2023.**

After completing this reading, you should be able to:

- a. compare generative AI and traditional AI/ML algorithms.
- b. explain the challenges generative AI systems pose for the financial sector, including those related to data privacy, embedded bias, model robustness, and explainability.
- c. examine the use of synthetic data to enhance AI models and the potential risks associated with synthetic data generation and application.
- d. evaluate the cybersecurity threats and potential impact on financial stability posed by the use of generative AI in the financial sector.

### 98. Artificial Intelligence and the Economy: Implications for Central Banks

**BIS Annual Economic Report, Section 3. Artificial intelligence and the economy: implications for central banks, June 2024.**

After completing this reading, you should be able to:

- a. identify and describe the risks arising from the widespread use of AI applications in the financial sector.
- b. describe how central banks can harness AI to fulfill their policy objectives.
- c. explain the macroeconomic impact of AI, including implications for firms' productive capacity and investment, labor productivity, household consumption, economic output, inflation, and fiscal sustainability.
- d. explain how the use of AI presents new opportunities and challenges for central banks, including the central banks' role as users and providers of data, and the trade-offs posed by their use of both internally-developed and external AI models.

### 99. Interest Rate Risk Management by EME Banks

**"Interest Rate Risk Management by EME Banks," BIS Quarterly Review, September 2023.**

After completing this reading, you should be able to:

- a. describe the mechanisms through which changes in market interest rates affect a bank's economic value and the key methods banks use to manage interest rate risk.
- b. compare the methods banks in emerging market economies (EME) and banks in advanced economies have historically used to manage their interest rate risk and how these methods affected their vulnerability to changes in interest rates.
- c. explain the recent changes in EME banks' exposure to interest rate risk and the importance of hedging this risk.

### 100. Laying a Robust Macro-Financial Foundation for the Future

**BIS Annual Economic Report, Section 1. Laying a robust macro-financial foundation for the**

**future, June 2024.**

After completing this reading, you should be able to:

- a. explain why the sudden increase in inflation that reached a peak in 2022 following the COVID-19 pandemic did not result in a full-scale global recession.
- b. identify and describe key factors that played a role in the process of disinflation around the world over the past year.
- c. describe policy measures introduced and implemented by different central banks aimed at driving their economies toward meeting inflation targets.
- d. discuss how monetary policy changes enacted by central banks to reduce inflation impacted equity prices, credit spreads, bond and equity volatilities, and bank lending.
- e. describe monetary, fiscal, prudential, and structural policies that need to be adopted to promote (long-term) sustainable economic growth and low inflation.

#### **101. The Rise and Risks of Private Credit**

**“The Last Mile: Financial Vulnerabilities and Risks, Chapter 2: The Rise and Risks of Private Credit,” IMF Global Financial Stability Report, April 2024.**

After completing this reading, you should be able to:

- a. describe characteristics of private credit, including its typical investors and borrowers, and compare private credit to other types of loans and fixed-income instruments.
- b. explain the return profile and growth profile of the private credit asset class, and compare the historical returns of private credit to those of other asset classes.
- c. describe and assess the risks and vulnerabilities related to private credit, and explain how private credit can pose risks to financial stability.
- d. assess potential policy recommendations that could help mitigate the risks associated with private credit.

#### **102. Monetary and Fiscal Policy: Safeguarding Stability and Trust**

**BIS Annual Economic Report, Section 2: Monetary and fiscal policy: safeguarding stability and trust, June 2023.**

After completing this reading, you should be able to:

- a. compare and contrast the channels through which fiscal policy and monetary policy influence a country’s economic activity and financial markets, and define the “region of stability” in terms of their joint policy stances.
- b. describe the consequences of breaching the boundaries of the region of stability, and how these consequences have evolved over time in advanced economies and in emerging market economies.
- c. describe the risks that global economies face as a result of high public debt levels, including the potential for these high debt levels, in combination with other factors, to drive tension between fiscal policy and monetary policy.

#### **103. Regulating the Crypto Ecosystem: The Case of Unbacked Crypto Assets**

**“Regulating the Crypto Ecosystem: The Case of Unbacked Crypto Assets,” IMF Fintech Notes, September 2022.**

After completing this reading, you should be able to:

- a. define and describe crypto assets, including the categories broadly used by global financial regulators to classify them.
- b. evaluate the key components within the crypto ecosystem, the potential risks generated by these components, and potential regulatory responses to address those risks.
- c. identify and describe some of the global approaches to the regulation of unbacked crypto assets, including the BCBS’ proposed treatment of banks’ exposures to crypto assets.
- d. examine the considerations and steps introduced by the Bali Fintech Agenda (BFA) for developing a regulatory framework for crypto assets.

#### **104. Digital Resilience and Financial Stability: The Quest for Policy Tools in the Financial Sector**

**“Digital Resilience and Financial Stability, The Quest for Policy Tools in The Financial Sector,” Jose Ramon Martinez, Banco de Espana, April 2023.**

After completing this reading, you should be able to:

- a. describe characteristics of cyber risks and information/communication technology (ICT) risks faced by financial institutions.
- b. assess the interactions between cyber and ICT risks and financial risks and explain how cyber and ICT risk events at financial institutions can lead to systemic financial risk.

- c. describe potential macroprudential tools and policy measures that can be used to address cyber risks and ICT risks and explain challenges to the adoption of each one.

The following is a review of the Risk Management and Investment Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Ang, Chapter 6.

## READING 85

# FACTOR THEORY

Study Session 13

### EXAM FOCUS

In this reading, we introduce factor theory and factor risk. A key point is that it is not the exposure to an asset that is rewarded, but the exposure to the underlying factors. The risk of these factors is being rewarded with risk premiums. Several factor theories are introduced, including the capital asset pricing model (CAPM) and multifactor models. For the exam, understand the key assumptions of the CAPM while recognizing the model's limitations in a real-world setting, and be able to contrast the CAPM with the assumptions of multifactor models. Through multifactor models, we introduce the concept of a stochastic discount factor, which is a random variable used in pricing an asset. Finally, be familiar with the efficient market hypothesis, since it identifies areas of market inefficiencies that can be exploited through active management.

### MODULE 85.1: FACTORS THAT IMPACT ASSET PRICES AND THE CAPM

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#### LO 85.a: Describe factors that impact asset prices and explain the theory of factor risk premiums.

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In the context of factor investing, it is easiest to think of assets as bundles of **factor risks**, where exposure to the different factor risks earns risk premiums. The underlying **factors** may include the market (which is a tradable investment factor), interest rates, or investing styles (including value/growth, low volatility, or momentum). Factors may also be classified as fundamental macroeconomic factors, such as inflation and economic growth.

**Factor theory** is based on an analysis of factor risks. Factor risks represent exposures to *bad times*, where these exposures are rewarded with risk premiums. Factor theory is based on three primary principles:

1. *Factors are important, not assets.* It is not exposure to the specific asset that matters, rather the exposure to the underlying risk factors. As a result, investors must look through assets and understand the underlying factor risks.
2. *Assets represent bundles of factors.* Assets typically represent bundles of risk factors, although some assets, like equities and government bonds, can be thought of as

factors themselves. Other assets, including corporate bonds, private equity, and hedge funds, contain many factors, such as equity risk, interest rate risk, volatility risk, and default risk. Assets' risk premiums reflect these risk factors.

3. *Investors have differing optimal risk exposures.* Investors each have different optimal exposures to risk factors. One of the important factors is volatility. Higher volatility results in higher asset risks during bad times. One important recent example of bad times was the 2007–2009 financial crisis. In return for bearing factor risks, investors require compensation through a risk premium (e.g., a volatility premium for volatility risk) during normal times. Economic growth represents another factor to which investors want different exposures.

Bad times could represent economic bad times, including high inflation and low economic growth. They could also represent bad times for investing, including poorly performing investments or markets. Factors are all unique and each represents exposure to a different set of bad times.

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### **LO 85.b: Discuss the capital asset pricing model (CAPM) including its assumptions and explain how factor risk is addressed in the CAPM.**

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The **capital asset pricing model (CAPM)** describes how an asset behaves not in isolation, but in relation to other assets and to the market. The CAPM views not the asset's own volatility as the relevant measure, but its covariance with the market portfolio, as measured by the asset's *beta*.

The CAPM assumes that the only relevant factor is the market portfolio, and risk premiums are determined solely by beta. As mentioned, risk premiums are important because they compensate investors for losses during bad times. Risk here is determined by the assets' movements relative to each other, and not by the assets in isolation.

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### **LO 85.c: Explain the implications of using the CAPM to value assets, including equilibrium and optimal holdings, exposure to factor risk, its treatment of diversification benefits, and shortcomings of the CAPM.**

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## **Implications of Using the CAPM**

The CAPM holds six important lessons.

### ***Lesson 1: Hold the factor, not the individual asset.***

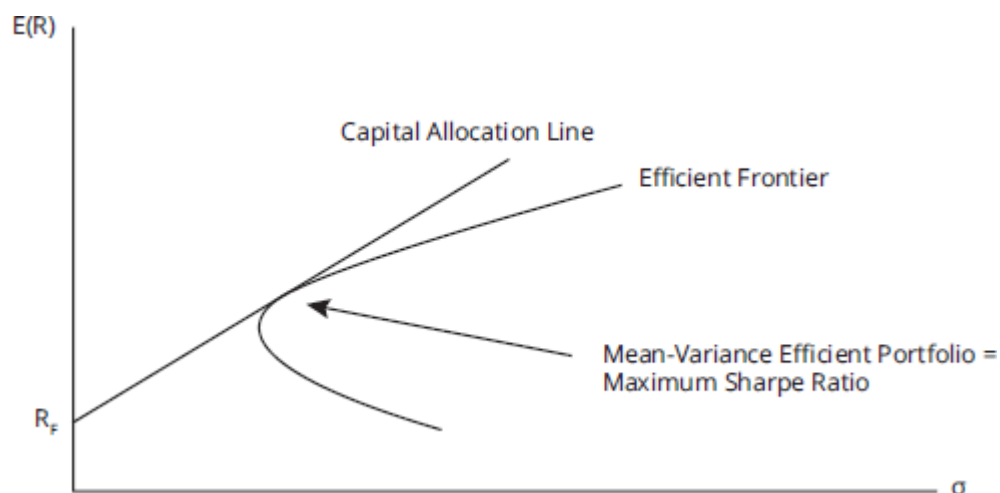
In a CAPM world, stocks are held in proportion to their market capitalization, where the sole factor is the market portfolio. The market portfolio can be constructed by holding many assets, which helps diversify away *idiosyncratic (firm-specific) risk*, leaving only *systematic (market) risk*. Individual stocks have risk premiums, which compensate investors for being exposed to the market factor. Market risk affects all investors exposed to the market portfolio.

According to the CAPM, investors do not wish to hold assets in isolation, because diversification improves the risk-return profile of a portfolio. The concept is simple: diversification helps ensure that bad returns from one asset will be offset by the returns

of other assets that perform well. This also improves Sharpe ratios (i.e., risk premium divided by total risk). Investors continue to diversify until they are left with the market portfolio, which represents the optimal diversified portfolio.

*Mean-variance efficient portfolio.* Portfolio diversification and Sharpe ratios can be graphically represented by the mean-variance **efficient frontier**. When investors hold portfolios that combine the risky asset and the risk-free asset, the various risk-return combinations are represented by the **capital allocation line (CAL)**. The risky asset in this case is the *mean-variance efficient (MVE) market portfolio*, which is efficient because it represents the maximum Sharpe ratio given investors' preferences. The specific combination of the risk-free asset and MVE portfolio depends on investors' risk aversions.

**Figure 85.1: Capital Allocation Line**



*Equilibrium.* In equilibrium, demand for an asset equals supply, and since under the CAPM all investors hold the risky MVE market portfolio, the market is the factor. For equilibrium to happen, someone must hold the MVE portfolio as the risky asset. If no investor held the risky asset, the risky asset must be overpriced, and its expected return must be too low. This situation cannot represent an equilibrium state. Since under CAPM the expected payoff of an asset remains constant, the asset's expected return must increase as its price falls. In equilibrium, the risk factor is the market, and it has a risk premium. The market factor is a function of investor risk aversions and utilities, and risk premiums will not disappear since investors cannot use arbitrage to remove systematic risk.

**Lesson 2: Investors have their own optimal factor risk exposures.**

Every investor holds the same risky MVE market portfolio, but the proportion in which they hold it differs. Investors hold different combinations of the risk-free asset and the risky portfolio, representing various positions along the CAL.

**Lesson 3: The average investor is fully invested in the market.**

An investor with an average risk aversion would hold 100% of the risky MVE market portfolio, which represents the tangency point of the MVE frontier and the CAL. The average investor's risk aversion is, therefore, the risk aversion of the market.

#### ***Lesson 4: Exposure to factor risk must be rewarded.***

When all investors invest in the same risky MVE portfolio, the CAL for an investor is called the **capital market line (CML)** in equilibrium. The risk premium of the CML depends on an investor's risk aversion and the volatility of the market portfolio:

$$E(R_M) - R_F = \bar{\gamma} \times \sigma_M^2$$

where  $E(R_M) - R_F$  is the market risk premium,  $\bar{\gamma}$  is the average investor's risk aversion, and  $\sigma_M^2$  is the market portfolio's variance. During volatile market times (e.g., the 2007–2009 financial crisis), equity prices typically fall and expected returns increase. In the CAPM world, the risk premium is proportional to the market variance. Because market variance removes all idiosyncratic risk, the remaining systematic risk should be rewarded through the risk premium. When the average investor's risk aversion increases, the market risk premium should also increase.

#### ***Lesson 5: Risk is measured as beta exposure.***

An individual asset's risk is measured as factor exposure to the asset, and higher factor exposures to the asset indicate higher expected returns (assuming the risk premium is positive). The risk premium of an individual asset is derived under the CAPM formula using beta pricing to construct the **security market line (SML)**. The formula states that:

$$E(R_i) - R_F = \frac{\text{cov}(R_i, R_M)}{\text{var}(R_M)} \times [E(R_M) - R_F] = \beta_i \times [E(R_M) - R_F]$$

where  $R_i$  is the individual stock's return,  $R_F$  is the risk-free rate, and **beta** is a function of the market variance and the asset's co-movement with the market:  $[\beta_i = \text{cov}(R_i, R_M) / \text{var}(R_M)]$ . Higher co-movements denote higher betas, which correspond to higher risk premiums. Whereas previously we looked at systematic risk and diversification, beta looks at idiosyncratic risk and the lack of diversification.

Higher betas imply lower diversification benefits. Investors tend to find high betas (high sensitivities to market returns) unattractive, and, therefore, want to be compensated with higher expected returns. On the other hand, low beta assets are valuable because they do comparatively well when markets perform poorly, offering significant diversification benefits. During the 2007–2009 financial crisis, certain assets (safe havens like gold and government bonds) became so attractive that they had negative expected returns. This meant investors actually paid to hold these assets!

#### ***Lesson 6: Valuable assets have low risk premiums.***

The CAPM risk premium represents the reward investors receive for holding the asset in bad times. Since the market portfolio is the risk factor, bad times indicate low market returns. Assets that have losses during periods of low market returns have high betas, which indicates they are risky and, therefore, should have high risk premiums. Low beta assets have positive payoffs when the market performs poorly, making them valuable to investors. As a result, investors do not require high risk premiums to hold these assets.

## Shortcomings of the CAPM

The CAPM makes several simplifying assumptions that are necessary to make the model work; however, many of these assumptions are considered overly simplistic or not reflective of the real world. The assumptions of the CAPM break down especially in illiquid, inefficient markets where information may be costly and not available to all investors. We look at seven of these assumptions:

1. *Investors only have financial wealth.* Investors have unique income streams and liabilities. Liabilities are often denominated in real terms, and income streams are risky because incomes decline during periods of low economic growth. As a result, both inflation and income growth are important factors. In general, investors have many factors that contribute to wealth, including human capital (or labor income risk).
2. *Investors have mean-variance utility.* Mean-variance utility assumes a symmetric treatment of risk. In reality, investors have an asymmetric view of risk, disliking losses more than they like gains, which deviates from the CAPM assumptions. Therefore, in the real world, stocks exhibit different levels of downside risks. Those with higher downside risks should offer higher returns.
3. *Investors have a single period investment horizon.* While not a main assumption of the CAPM, a single period restriction does not hold in the real world. In the CAPM, all investors hold the market portfolio, which does not require rebalancing. However, the optimal strategy for long-term investors is to rebalance, which is a multi-period strategy.
4. *Investors have homogeneous (identical) expectations.* The assumption that all investors share the same expectations is not realistic in the real world, because investors have heterogeneous (differing) expectations. This can produce significant departures from the CAPM.
5. *Markets are frictionless (no taxes or transaction costs).* We all know that taxes and transaction costs affect investor returns; therefore, the CAPM assumption of frictionless markets does not hold in the real world. For illiquid securities, transaction costs can be very high, further heightening the deviations from the CAPM. In addition, investors have heterogeneous beliefs, but they may not be able to fully act on differing expectations if there are trading restrictions (e.g., a prohibition on short selling). When this happens, stock prices reflect only the expectations of those who believe stock prices will rise, causing asymmetries in the market. This is a deviation from the CAPM.
6. *All investors are price takers.* In the real world, investors are often price setters and not price takers. Large (institutional) investors frequently trade on special knowledge, and large trades will often move the market.
7. *Information is free and available to everyone.* In reality, information itself can be a factor. Information is often costly and unavailable to certain investors, which is a deviation from the CAPM.



### MODULE QUIZ 85.1

1. Which of the following concepts would least likely meet the definition of a factor?

- A. Market.
  - B. Volatility.
  - C. Hedge funds.
  - D. Momentum investing style.
2. According to the capital asset pricing model (CAPM), in equilibrium, all investors hold the mean-variance efficient portfolio. Which of the following investor types is an exception to this assumption?
- A. Infinitely risk-averse investors.
  - B. Infinitely risk-tolerant investors.
  - C. Investors who hold some of the risk-free asset.
  - D. Investors who hold the market portfolio.
3. Assets that have losses during periods of low market returns have:
- A. low betas and low risk premiums.
  - B. high betas and low risk premiums.
  - C. low betas and high risk premiums.
  - D. high betas and high risk premiums.
4. Which of the following statements best describes the relationship between asset payoffs and “bad times” events (high inflation, low economic growth, or both)?
- A. The higher the expected payoff of an asset in bad times, the higher the asset’s expected return.
  - B. The higher the expected payoff of an asset in bad times, the lower the asset’s expected return.
  - C. The expected payoff of an asset in bad times is unrelated to the asset’s expected return, because it depends on investor preferences.
  - D. The expected payoff of an asset in bad times is unrelated to the asset’s expected return, because arbitrageurs eliminate any expected return potential.
5. Which of the following statements least likely represents a limitation of the capital asset pricing model (CAPM)?
- A. All investors are price takers.
  - B. Information is costless to obtain.
  - C. All investors have the same expectations.
  - D. There are uniform taxes and transaction costs.

## MODULE 85.2: MULTIFACTOR MODELS, PRICING KERNELS, AND EFFICIENT MARKET THEORY

### Multifactor Models

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#### LO 85.d: Describe multifactor models and compare and contrast multifactor models to the CAPM.

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As mentioned, the CAPM is a single-factor model that looks at the market as the only factor and defines bad times as low returns to the market portfolio. By contrast, **multifactor models** incorporate other risk factors, including low economic growth, low GDP growth, or low consumption. One of the earliest multifactor models was **arbitrage pricing theory (APT)**, which describes expected returns as a linear function of exposures to common (i.e., macroeconomic) risk factors.

The lessons from multifactor models are similar to the lessons from the CAPM:

1. *Diversification is beneficial.* In the CAPM, the market removes (diversifies away) idiosyncratic risk. In multifactor models, it is the tradable version of a factor that removes this risk.
2. *Investors have optimal exposures.* Each investor has an optimal exposure to the market portfolio (in the CAPM) or to factor risks (in multifactor models).
3. *The average investor holds the market portfolio.* This is true under both the CAPM and multifactor models.
4. *Exposure to factor risk must be rewarded.* In the CAPM, the market factor is priced in equilibrium. In multifactor models, each factor has a risk premium, assuming no arbitrage or equilibrium.
5. *Risk is measured by a beta factor.* In the CAPM, an asset's risk is measured by its beta. In multifactor models, an asset's risk is measured by its factor exposures (i.e., factor betas).
6. *Valuable assets have low risk premiums.* Assets that have a positive payoff in bad times are attractive, and, therefore, have low risk premiums. In the CAPM, bad times are explicitly defined as low market returns.

## Pricing Kernels

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### LO 85.e: Explain how stochastic discount factors are created and apply them in the valuation of assets.

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Multifactor models define bad times over multiple factors. They use the concept of a **pricing kernel**, also known as the **stochastic discount factor (SDF)**, which represents a random variable used in pricing an asset. The SDF represents an index of bad times, where the bad times are indexed by a multitude of different factors and states. The SDF is denoted as  $m$  in the multifactor model, where  $m$  is a single variable that captures all bad times for any given  $a$  and  $b$  constants:

$$m = a + b \times R_m$$

The CAPM is a special case of this model, where  $m$  moves linearly with the market return. However, modeling returns as linear is a shortcoming of the CAPM, which can be improved upon by using the pricing kernel which allows for the assumption of nonlinearity.

We can expand this model to include various factor exposures ( $f_1, f_2$ , etc.) where SDF depends on a vector of these factors, where all the  $k$  factors represent different bad times:

$$m = a + b_1 f_1 + b_2 f_2 + \dots + b_k f_k$$

With multifactor pricing kernels, bad times can be defined as periods when an additional \$1 income becomes very valuable. Looking at bad times this way interprets SDF as a *marginal utility*. Periods of high marginal utility could arise from the loss of a job (resulting in low income, where the value of an extra dollar is high), low GDP growth, low consumption (resulting in current consumption below past consumption), or generally low economic growth.

## Pricing Kernels vs. Discount Rate Models

In a traditional discount rate model, the price of an asset is determined by discounting its future cash flows at the appropriate discount rate:

$$P_i = E \left[ \frac{\text{payoff}_i}{1 + E(R_i)} \right]$$

The discount rate is determined through the CAPM as:

$$E(R_i) = R_F + \beta_i \times [E(R_M) - R_F]$$

The SDF model can also be used to predict an asset's price, where we use the SDF as the relevant factor:

$$P_i = E[m \times \text{payoff}_i]$$

This equation helps explain the name "stochastic discount factor," since the payoffs are discounted using  $m$  as the relevant factor. The SDF is called a "pricing kernel," using the term kernel from statistics where we estimate  $m$  using the kernel estimator. Because the kernel is used to derive asset pricing, it is called a pricing kernel.

If we divide both sides of the equation by the asset's current price,  $P_i$ , the equation gives us a constant payoff formula, which we can then use to derive the risk-free asset:

$$\frac{P_i}{P_i} = E \left[ m \times \frac{\text{payoff}_i}{P_i} \right]$$

$$1 = E[m \times (1 + R_i)]$$

$$\frac{1}{1 + R_F} = E[m \times 1], \text{ when payoffs are constant}$$

We can also model an asset's risk premium similar to the CAPM, where  $[\beta_{i,m} = \text{cov}(R_i, m) / \text{var}(m)]$ :

$$E(R_i) - R_F = \frac{\text{cov}(R_i, m)}{\text{var}(m)} \times \left( -\frac{\text{var}(m)}{E(m)} \right) = \beta_{i,m} \times \lambda_m$$

Beta is multiplied by the price of the "bad times" risk, determined as:

$$\lambda_m = -\frac{\text{var}(m)}{E(m)}$$

This equation represents the inverse of factor risk (denoted by the negative sign). In short, assets that have a positive payoff in bad times are valuable to hold, leading to high prices and low expected returns.

The equation for expected return can also be modeled as having exposure to the risk-free rate and multiple betas in the SDF model. Each beta represents a different macroeconomic factor, such as inflation, economic growth, the market portfolio, or investment strategy:

$$E(R_i) = R_F + \beta_{i,1} \times E(f_1) + \beta_{i,2} \times E(f_2) + \dots + \beta_{i,k} \times E(f_k)$$

## Efficient Market Theory

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### LO 85.f: Describe efficient market theory and explain how markets can be inefficient.

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The APT was one of the earliest forms of the **efficient market theory**. The APT is a multifactor model where market participants—including active managers and arbitrageurs—move an asset's expected return toward a value that represents an equilibrium risk-return tradeoff. The APT uses systematic factors that cannot be removed through arbitrage. As a result, investors demand to be compensated for this risk in the form of a risk premium.

Another efficient market theory was developed by Sanford Grossman and Joseph Stiglitz (1980).<sup>1</sup> In their theory, markets are near-efficient and information is costless. Market efficiency is in part caused by active managers searching for areas of inefficiency, making markets more efficient in the process. We can expect to find these areas of inefficiency in illiquid market segments where information does not move freely and where these inefficiencies make it difficult to earn large profits. Note, however, that the assumption of costless information creates a circular argument: if there is no cost to information and prices already reflect all information, there wouldn't be a need to collect information. However, if no one collects information, then it cannot be fully reflected in asset prices.

Market efficiency is also described in the **efficient market hypothesis (EMH)**. The EMH implies that speculative trading is costly, and active managers cannot generally beat the market. The average investor, who holds the market portfolio, can beat the market simply by saving on transaction costs. Even if markets cannot be perfectly efficient, the EMH is still useful because it can help investors identify areas of market inefficiency that can be exploited through active management.

The EMH has been refined to improve upon the CAPM's shortcomings by allowing for imperfect information and various costs, including transaction, financing, and agency costs. Behavioral biases also represent inefficiencies, which have similar effects as frictions. Behavioral biases can be described either through a rational or behavioral explanation approach.

Under the *rational explanation* approach, losses during bad times are compensated by high returns. It is important to clearly define what bad times constitutes, and whether these bad times are actually bad for investors. For example, an investor who shorted the market would benefit, rather than incur losses, in a "bad times" scenario.

Under the *behavioral explanation* approach, it is agents' reactions (under/overreaction) to news that generates high returns. Perfectly rational investors are not prone to these biases, and they provide their own capital to take advantage of mispricing caused by biases. However, the markets may have barriers to the entry of capital that make it difficult to take advantage of mispricings, including structural barriers (e.g., certain investors are unable to take advantage of an opportunity) and regulatory barriers (e.g., minimum credit rating requirement of asset holdings). Structural barriers allow for behavioral biases to persist for a long time.

Ultimately, it is not the type of bias that matters, but whether the investor is different from the average investor who is subject to both rational and behavioral constraints, and whether return opportunities are expected to persist.



#### MODULE QUIZ 85.2

1. Market efficiency can be described with the efficient market hypothesis (EMH). Regarding the definition of EMH and the rational and behavioral explanations for this approach, the EMH suggests that:
  - A. speculative trading is costless.
  - B. active managers cannot generally beat the market.
  - C. under the behavioral explanation, losses during bad times are compensated for by high returns.
  - D. under the rational explanation, it is agents' under- or overreactions to news that generates high returns.

### KEY CONCEPTS

#### LO 85.a

Exposure to different factor risks earns risk premiums. Underlying factors may include the market, interest rates, investing styles, inflation, and economic growth. Factor risks represent exposures to bad times, and this exposure must be compensated for with risk premiums. There are three important principles of factor risk:

1. It is not exposure to the specific asset that matters, rather the exposure to the underlying risk factors.
2. Assets represent bundles of factors, and assets' risk premiums reflect these risk factors.
3. Investors each have different optimal exposures to risk factors, including volatility.

#### LO 85.b

The capital asset pricing model (CAPM) is a single-factor model that describes how an asset behaves in relation to other assets and to the market. The CAPM incorporates an asset's covariance with the market portfolio, measured by the asset's beta. In the CAPM world, the only relevant factor is the market portfolio, and risk premiums are determined solely by beta.

#### LO 85.c

The CAPM has six important lessons:

1. Hold the factor, not the individual asset.
2. Investors have their own optimal factor risk exposures.
3. The average investor is fully invested in the market.
4. Exposure to factor risk must be rewarded.
5. Risk is measured as beta exposure.
6. Valuable assets have low risk premiums.

The CAPM has six main shortcomings (i.e., unrealistic simplifying assumptions):

1. Investors only have financial wealth.

2. Investors have mean-variance utility.
3. Investors have a single period investment horizon.
4. Investors have homogeneous (identical) expectations.
5. Markets are frictionless (no taxes or transaction costs).
6. All investors are price takers.

#### LO 85.d

There are six lessons from the multifactor models:

1. Diversification is beneficial.
2. Investors have optimal exposures, to factor risks in multifactor models.
3. The average investor holds the market portfolio.
4. Exposure to factor risks must be rewarded through risk premiums.
5. Risk is measured by factor betas.
6. Valuable assets have low risk premiums.

#### LO 85.e

Multifactor models define bad times over multiple factors using a pricing kernel, also known as the stochastic discount factor (SDF). The SDF represents an index of bad times. The SDF is denoted as  $m$  in the multifactor model, representing a single variable that captures all bad times for any given  $a$  and  $b$  constants:

$$m = a + b \times R_m$$

The SDF model can also be set up using multiple factor exposures where factors represent different bad times.

The SDF model can be used to predict an asset's price, where SDF is the relevant factor  $m$ :

$$P_i = E[m \times \text{payoff}_i]$$

The asset's risk premium can be modeled using beta.

The risk premium equation can be set up using multiple factor exposures where factors represent different macroeconomic factors, including inflation, economic growth, the market portfolio, or investment strategy.

#### LO 85.f

Arbitrage pricing theory (APT) uses systematic factors that cannot be removed through arbitrage, and for which investors must be compensated for through risk premiums.

Another efficient market theory developed suggests that markets are near-efficient and information is costless. Active managers search for areas of inefficiency in illiquid market segments, making markets more efficient in the process.

The efficient market hypothesis (EMH) states that speculative trading is expensive, and active managers cannot beat the market on average. The EMH is useful because it helps investors identify areas of market inefficiency that active management can exploit. The

EMH has been refined to allow for imperfect information, various costs (transaction, financing, and agency), and behavioral biases.

Under the rational explanation of behavioral biases, losses during bad times are compensated for by high returns. Under the behavioral explanation, it is agents' under- or overreactions to news that generates high returns. Market barriers may make it difficult to take advantage of mispricings.

## ANSWER KEY FOR MODULE QUIZZES

### Module Quiz 85.1

1. **C** Assets, including corporate bonds, private equity, and hedge funds, are not considered factors themselves, but contain many factors, such as equity risk, interest rate risk, volatility risk, and default risk.  
  
Some assets, like equities and government bonds, can be thought of as factors themselves. Factors may also include the market (a tradable investment factor), interest rates, or investing styles (including value/growth, low volatility, or momentum). (LO 85.a)
2. **A** According to the CAPM, all investors hold a combination of the risky mean-variance efficient market portfolio and the risk-free asset. All investors hold the same market portfolio (therefore the mean-variance efficient portfolio is the market portfolio), and it is only the quantity of holdings that differs among investors. The only exception to this assumption is an *infinitely* risk-averse investor, who would only hold the risk-free asset. (LO 85.c)
3. **D** Assets that have losses during periods of low market returns have *high* betas (high sensitivity to market movements), which indicates they are risky and, therefore, should have *high* risk premiums. Low beta assets have positive payoffs when the market performs poorly, making them valuable to investors. As a result, investors do not require high risk premiums to hold these assets. (LO 85.c)
4. **B** The higher the expected payoff of an asset in bad times, the lower the asset's expected return. Assets that have a positive payoff in bad times are valuable to hold, leading to high prices and, therefore, low expected returns. (LO 85.c)
5. **D** The CAPM does not assume *uniform* taxes and transaction costs; it assumes there are *no* taxes or transaction costs (i.e., frictionless markets). The other limiting assumptions of the CAPM include:
  - Investors only have financial wealth.
  - Investors have mean-variance utility.
  - Investors have a single period investment horizon.
  - Investors have homogeneous (identical) expectations.
  - All investors are price takers.(LO 85.c)

## Module Quiz 85.2

1. **B** The EMH implies that speculative trading is costly, and active managers cannot generally beat the market. Under the rational explanation of behavioral biases, losses during bad times are compensated for by high returns. Under the behavioral explanation, it is agents' under- or overreactions to news that generates high returns. Market barriers may make it difficult to take advantage of mispricings. (LO 85.f)

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<sup>1</sup> Sanford J. Grossman and Joseph E. Stiglitz, "On the Impossibility of Efficient Markets," *American Economic Review* 70 (1980): 393-498.

The following is a review of the Risk Management and Investment Management principles designed to address the learning objectives set forth by GARP®. Cross-reference to GARP assigned reading—Ang, Chapter 7.

## READING 86

### FACTORS

Study Session 13

#### EXAM FOCUS

Macroeconomic factors have been linked to asset returns. The most important macro factors that affect returns are economic growth, inflation, and volatility. Volatility risk can be mitigated by investing in low-volatility assets or buying volatility protection in the derivatives market (e.g., buying put options). The capital asset pricing model (CAPM) is a single-factor model that relates asset returns to market risk. The Fama-French model is a multifactor model that adds a size factor and a value factor to the original CAPM market factor to explain stock returns. A momentum factor can also help explain asset returns. The momentum strategy far outpaces the size and value-growth strategies in terms of returns. However, momentum strategies are prone to crashes. For the exam, understand the risk and return profiles of each factor. Also, be aware of rational and behavioral explanations for each factor.

#### MODULE 86.1: VALUE INVESTING AND MACROECONOMIC FACTORS

##### Value Investing

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**LO 86.a: Describe the process of value investing and explain why a value premium may exist.**

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Risk premiums are driven by **factors**. Economy-wide (i.e., fundamental-based) factors such as inflation, volatility, productivity, economic growth, and demographics drive risk premiums. Additionally, factors related to tradeable investment styles such as momentum investing, value investing, and investing based on firm size drive returns.

A company's **book value** (i.e., net worth) per share is equal to total assets minus total liabilities divided by shares outstanding. It indicates, on a per-share basis, what a company would be worth if it liquidated its assets and paid off its liabilities. Value stocks have high book-to-market ratios while growth stocks have low book-to-market ratios, where "market" indicates the company's stock price. An investment strategy that is long value stocks and short growth stocks is called a **value-growth strategy**.

Historically, value stocks have significantly outperformed growth stocks. One dollar invested in a value-growth strategy in 1965 would be worth more than \$6 around 2012, with a peak value of nearly \$8 in 2006 and 2007. During the more than 40-year period, value stock returns experienced a sharp downturn during the tech boom, during the late 1990s, during the financial crisis in 2007–2009, and again in 2011. Overall, however, value investing appears to work. Are returns higher than growth investing returns due to a systematic factor? Alternatively, is there a value risk premium? Risk factors offer premiums to investors to compensate them for bearing losses in bad times, like the late 1990s and 2007–2009. Rational and behavioral explanations for the value premium will be discussed in detail in LO 86.e.

## Macroeconomic Factors

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### **LO 86.b: Explain how different macroeconomic risk factors, including economic growth, inflation, and volatility, affect asset returns and risk premiums.**

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Macroeconomic factors, such as increasing inflation or slowing economic growth, affect all investors to varying degrees. Most, though not all, investors are hurt by rising inflation, slowing economic growth, or both. But it is not the level of the factor that matters, it is the shock (i.e., unanticipated changes) to a factor. For example, asset prices generally fall when inflation unexpectedly increases. Economic growth, inflation, and volatility are the three most important macro factors that affect asset prices.

#### ***Economic Growth***

Risky assets like equities generally perform poorly during periods of low economic growth. Less-risky assets like bonds, and especially government bonds, tend to perform well during periods of slow growth. For the investor who can weather a downturn easily, she should invest in equities because returns will be greater over the long run. Periods of stronger growth generally last longer than downturns. For the investor who cannot bear large losses during a period of slow growth, she should invest in bonds. Her portfolio will likely perform better during the downturn but worse in the long run.

Figure 86.1 reports the returns of large and small stocks, as well as government, investment grade, and junk (high-yield) bonds during expansions and retractions as defined by the National Bureau of Economic Research (NBER). Returns are from Ibbotson Morningstar and cover the period 1952 through 2011. During periods of recession, government and investment grade bonds outperform equities and high-yield bonds, yielding 12.3% and 12.6%, respectively. During expansion periods, equities outperform bonds with large stocks yielding 12.4% and small stocks yielding 16.8%. High-yield bond returns appear indifferent to changes in economic growth, yielding 7.4% in recessions and 7.7% in expansions.

Figure 86.1 also reports returns based on quarter-on-quarter real GDP growth and quarter-on-quarter consumption growth (i.e., real personal consumption expenditures). The patterns are similar to those exhibited by NBER expansion/recession data. Equities outperform in periods of high real GDP growth and high consumption growth, while bonds outperform in periods of low real GDP growth and low consumption growth. High-yield bonds perform slightly better in high-growth periods.

**Figure 86.1: Investment Returns During Expansions and Recessions**

	Large Stocks	Small Stocks	Government Bonds	Corporate Bonds	
				Investment Grade	High Yield
<b>Returns</b>					
Full sample	11.3%	15.3%	7.0%	7.0%	7.6%
<b>Business Cycles</b>					
Recessions	5.6%	7.8%	12.3%	12.6%	7.4%
Expansions	12.4%	16.8%	5.9%	6.0%	7.7%
<b>Real GDP</b>					
Low	8.8%	12.2%	10.0%	9.7%	7.0%
High	13.8%	18.4%	3.9%	4.4%	8.2%
<b>Consumption</b>					
Low	5.6%	5.6%	9.6%	9.1%	7.1%
High	17.1%	25.0%	4.4%	5.0%	8.2%
<b>Inflation</b>					
Low	14.7%	17.6%	8.6%	8.8%	9.2%
High	8.0%	13.0%	5.4%	5.3%	6.0%

In terms of volatility, both stocks and bonds are more volatile during downturns and periods of low growth. For example, large stock return volatility was 23.7% during recessions and 14.0% during expansions. Government bonds perform best during recessions but are also more volatile during these periods (15.5% volatility during recessions and 9.3% volatility during expansions).

### ***Inflation***

High inflation is generally bad for both stock and bond prices and returns. Figure 86.1 indicates that all categories perform better in low inflation versus high inflation periods. Volatilities are also higher in high inflation periods. Large and small stocks return 14.7% and 17.6%, respectively, during low inflation periods, and 8.0% and 13.0% during high inflation periods. Bond yields of 8.6%, 8.8%, and 9.2% (government, investment grade, and high-yield bonds, respectively) during low inflation periods exceeded returns during high inflation periods by approximately 3.0%. Bonds are fixed payment securities. As such, it is clear that bonds should perform poorly in high inflation times. Inflation lowers real bond returns. It is less clear that stocks perform poorly in high inflation times since they represent ownership of real, productive companies, not a claim to a stream of fixed cash flows.

### ***Volatility***

Volatility is an important risk factor for many asset classes. The CBOE Volatility Index (VIX) represents equity market volatility. The correlation between the VIX and stock returns has historically indicated a negative relationship (correlation coefficient of -0.39 between 1986 and 2011). This means that stock returns tend to drop when the VIX (equity volatility) increases.