March 2018 **SchweserNotes™** Level I

CAIA® Exam Prep

Hedge Funds, Private Equity, Structured Products, and Risk Management & Portfolio Management

eBook 2

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Getting Started

Level I CAIA® Exam

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Again, thank you for trusting Kaplan Schweser with your CAIA exam preparation!

Sincerely,

Derek Burkett

Derek Burkett, CFA, FRM, CAIA
VP, Product Management, Kaplan Schweser

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Book 2: Hedge Funds, Private Equity, Structured Products, and Risk Management & Portfolio Management

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CAIA® 2018 MARCH LEVEL I SCHWESERNOTES™ BOOK 2: HEDGE FUNDS, PRIVATE EQUITY, STRUCTURED PRODUCTS, AND RISK MANAGEMENT & PORTFOLIO MANAGEMENT

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Readings and Learning Objectives

Readings

Topic 4: Hedge Funds

Alternative Investments: CAIA Level I. Wiley. Third Edition, 2015. ISBN: 978-1-119-00336-6. Part Three, Hedge Funds, Chapters 16–21.

Topic 5: Private Equity

Alternative Investments: CAIA Level I. Wiley. Third Edition, 2015. ISBN: 978-1-119-00336-6. Part Four, Private Equity, Chapters 22–24.

Topic 6: Structured Products

Alternative Investments: CAIA Level I. Wiley. Third Edition, 2015. ISBN: 978-1-119-00336-6. Part Five, Structured Products, Chapters 25–28.

Topic 7: Risk Management and Portfolio Management

Alternative Investments: CAIA Level I. Wiley. Third Edition, 2015. ISBN: 978-1-119-00336-6. Part Six, Risk Management and Portfolio Management, Chapters 29–32.

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Learning Objectives

Topic 4: Hedge Funds

Topic 4.1: Structure of the Hedge Fund Industry

16.1: Demonstrate knowledge of the distinguishing features of hedge funds and their growth and concentration over time. (p. 1)

For example:
- Identify and describe the three primary elements of hedge funds.
- Recognize the six investment flexibilities offered by hedge funds.
- Discuss the reasons for hedge fund industry growth and concentration.
- Recognize events that led to the trend of consolidation within the hedge fund industry.

16.2: Demonstrate knowledge of hedge fund fees. (p. 3)

For example:
- Recognize typical hedge fund fee arrangements.
- Calculate annual hedge fund fees.
- Describe and apply high-water marks (HWMs) and hurdle rates.
- Discuss the potential effects of incentive fees on hedge fund manager behavior.
- Recognize and apply the annuity view of hedge fund fees.
- Recognize and apply the option view of incentive fees and its implications on manager behavior.
- Describe the empirical evidence regarding hedge fund fees and managerial behavior.

16.3: Demonstrate knowledge of various types of hedge funds. (p. 10)

For example:
- List hedge fund strategies.
- Contrast single-manager hedge funds, funds of funds, and multistrategy funds.

16.4: Demonstrate knowledge of various hedge fund strategies. (p. 12)

For example:
- Identify and describe equity strategies.
- Identify and describe event-driven and relative value strategies.
- Identify and describe absolute return strategies.
- Identify and describe diversified strategies.

16.5: Demonstrate knowledge of hedge fund investment programs. (p. 16)

For example:
- Identify and explain the parameters that may be used in a hedge fund investment program.
- Discuss three caveats that relate to the documented hedge fund investment performance and diversification benefits.
- Describe the characteristics and potential benefits of opportunistic hedge fund investing.

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16.6: Demonstrate knowledge of the market impact of hedge funds. (p. 17)

For example:
- Discuss the evidence regarding the market impact of hedge funds during the Asian currency crisis of 1997.
- Discuss the evidence regarding the market impact of hedge funds during the crisis of 2007.

16.7: Demonstrate knowledge of hedge fund indices. (p. 18)

For example:
- Describe hedge fund indices.
- Describe the challenges caused by management and incentive fees in constructing hedge fund indices.
- Recognize the challenges of including managed futures in hedge fund indices.
- Compare asset-weighted hedge fund indices and equally weighted hedge fund indices.
- Discuss the role of the size of the hedge fund universe in the construction of a hedge fund index.
- Recognize the concepts of representativeness and data biases (e.g., survivorship, selection, instant history, liquidation) and their effects on hedge fund returns reported by databases.
- Recognize the challenges involved in defining hedge fund strategies, and the effect of style drift.
- Identify issues that determine investability of hedge fund indices.

Topic 4.2: Macro and Managed Futures Funds

17.1: Demonstrate knowledge of major distinctions within the category of macro and managed futures funds. (p. 32)

For example:
- Distinguish between discretionary fund trading and systematic fund trading.
- Define technical analysis and fundamental analysis, and discuss the reasons for pursuing each.

17.2: Demonstrate knowledge of global macro funds. (p. 28)

For example:
- Describe the key characteristics of global macro funds.
- Be familiar with examples that illustrate the foundation of global macro trading strategies.
- Recognize the main risks (i.e., market, event, and leverage) of macro investing.

17.3: Demonstrate knowledge of the historical performance of macro investing. (p. 30)

For example:
- Recognize inferences that can be drawn from comparing definable characteristics of macro investing with its historical stand-alone and portfolio performance.

17.4: Demonstrate knowledge of managed futures. (p. 30)

For example:
- Describe the key characteristics of managed futures funds.
- Discuss regulation, background, and organizational structures (i.e., public commodity pools, private commodity pools, and individually managed accounts) of the managed futures industry.

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17.5: Demonstrate knowledge of systematic trading. (p. 33)

For example:
- Identify methods for and issues involved in deriving systematic trading rules.
- Recognize key questions to ask when evaluating individual trading strategies.
- Describe key components of methods used to validate systematic trading rules and the detection and effects of trading rule degradation.

17.6: Demonstrate knowledge of systematic trading strategies. (p. 34)

For example:
- Describe the characteristics of trend-following strategies.
- Define and apply simple moving averages, weighted moving averages, and exponential moving averages.
- Define and apply breakout trading rules.
- List the conclusions of research on the nature and efficacy of trend-following strategies.
- Identify non-trend-following strategies and their trading signals.
- Describe the characteristics of relative value strategies.

17.7: Demonstrate knowledge of empirical research on managed futures. (p. 41)

For example:
- Discuss empirical evidence regarding managed futures returns and the downside risk protection offered by managed futures.
- Describe the reasons why managed futures might provide superior returns.
- Describe the risks of managed futures funds.

17.8: Demonstrate knowledge of historical performance of managed futures and macro funds. (p. 43)

For example:
- Recognize inferences that can be drawn from comparing definable characteristics of managed futures and macro investing with their historical stand-alone and portfolio performance.

Topic 4.3: Event-Driven Hedge Funds

18.1: Demonstrate knowledge of the sources of event-driven strategy returns. (p. 48)

For example:
- Explain the insurance selling view of event-driven strategy returns.
- Explain and apply the binary option view of event-driven strategy returns.

18.2: Demonstrate knowledge of activist investing. (p. 50)

For example:
- Define activist investing, and identify the components of activist investment strategies.
- Identify the various roles in corporate governance.
- Identify the five dimensions of shareholder activists and the key players in financial activism.
- Discuss agency costs and the conflicts of interest between shareholders and managers.

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- Recognize and discuss approaches commonly used by activist investors to generate alpha.
- Recognize inferences that can be drawn from three types of activist agendas, comparing definable characteristics of activist investing with its historical stand-alone and portfolio performance.

18.3: Demonstrate knowledge of merger arbitrage. (p. 53)

For example:
- Recognize the characteristics of merger arbitrage.
- Recognize the characteristics of stock-for-stock mergers.
- Discuss and apply traditional merger arbitrage to stock-for-stock mergers.
- Discuss the effects of third-party bidders and bidding wars on merger arbitrage.
- Describe regulatory risk in the context of merger arbitrage.
- Describe financing risk in the context of merger arbitrage.
- Recognize inferences that can be drawn from comparing definable characteristics of merger arbitrage with its historical stand-alone and portfolio performance.

18.4: Demonstrate knowledge of distressed securities hedge funds. (p. 55)

For example:
- Distinguish between distressed debt strategies in hedge funds and in private equity.
- Identify key components of the bankruptcy process.
- Define a naked option position.
- Describe the risks and returns of short sales of distressed equities.
- Determine the effect of recovery values on annualized returns for a strategy of buying undervalued debt during the bankruptcy process.
- Recognize activist approaches to investing in distressed securities.
- Describe the characteristics of capital structure arbitrage.
- Explain the strategy of buying distressed firms using distressed securities.
- Recognize inferences that can be drawn from comparing definable characteristics of distressed securities funds with their historical stand-alone and portfolio performance.

18.5: Demonstrate knowledge of event-driven multistrategy funds. (p. 59)

For example:
- Describe key characteristics of event-driven multistrategy funds.
- Recognize inferences that can be drawn from comparing definable characteristics of event-driven multistrategy funds with their historical stand-alone and portfolio performance.

Topic 4.4: Relative Value Hedge Funds

19.1: Demonstrate knowledge of relative value strategies. (p. 64)

For example:
- Recognize the relative value strategy, and list four styles of relative value hedge funds.
- Describe the classic relative value strategy trade.

19.2: Demonstrate knowledge of convertible bond arbitrage. (p. 65)

For example:
- Define and describe the classic convertible bond arbitrage trade.

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- Define convertible bonds, and apply the unbundling approach for pricing convertible bonds.
- Define busted, hybrid, and equity-like convertibles.
- Define, describe, and apply the concept of delta.
- Define and describe the concept of gamma and theta.
- Explain and determine the effects of gamma and volatility on the profitability of a delta-neutral position.
- Discuss short selling in the context of convertible arbitrage.
- Recognize the role complexity plays in making convertible bond arbitrage attractive to some hedge fund managers.
- Identify the four reasons that issuers may continue to offer convertible bonds at attractive prices.
- Identify the components of convertible arbitrage returns.
- Recognize and discuss return drivers and risks of convertible bond arbitrage.
- Recognize inferences that can be drawn from comparing definable characteristics of convertible arbitrage funds with their historical stand-alone and portfolio performance.

19.3: Demonstrate knowledge of volatility arbitrage. (p. 72)

For example:

- Define and describe the concepts of vega and anticipated volatility.
- Recognize instruments used by volatility arbitrage funds.
- Identify and apply the approach for determining the final payoff of a variance swap and a volatility swap.
- Compare the risks of exchange-traded derivatives and over-the-counter (OTC) derivatives.
- Recognize the types of volatility arbitrage strategies.
- Discuss the characteristics of market-neutral volatility funds.
- Recognize the challenges of estimating and forecasting dispersion.
- Discuss the characteristics of tail risk strategies and how their performance depends on correlation among assets.
- Discuss the characteristics of dispersion trades.
- Recognize inferences that can be drawn from comparing definable characteristics of volatility arbitrage funds with their historical stand-alone and portfolio performance.

19.4: Demonstrate knowledge of fixed-income arbitrage. (p. 76)

For example:

- Discuss duration neutrality, leverage, and liquidity in the context of fixed-income arbitrage.
- Recognize types and characteristics of fixed-income arbitrage strategies.
- Discuss the risks and returns of sovereign debt in fixed-income arbitrage strategies, and apply the concept of modified duration to bond returns and volatility.
- Recognize the characteristics of asset-backed and mortgage-backed securities strategies.
- Discuss and determine the effects of prepayment risk and option-adjusted spreads on asset-backed and mortgage-backed securities strategies.
- Analyze the risks of asset-backed and mortgage-backed securities arbitrage.
- Recognize inferences that can be drawn from comparing definable characteristics of fixed-income arbitrage with its historical stand-alone and portfolio performance.

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19.5: Demonstrate knowledge of relative value multistrategy funds. (p. 80)

For example:

- Describe key characteristics of relative value multistrategy funds, and recognize inferences that can be drawn from comparing definable characteristics of relative value multistrategy with their historical stand-alone and portfolio performance.

Topic 4.5: Equity Hedge Funds

20.1: Demonstrate knowledge of sources of return for equity hedge funds. (p. 86)

For example:

- Describe the general design of an equity hedge strategy.
- Discuss providing liquidity as a source of return for equity hedge funds.
- Discuss providing informational efficiency as a source of return for equity hedge funds.
- Discuss the process of using factor analysis to enhance returns for equity hedge funds.

20.2: Demonstrate knowledge of market anomalies. (p. 88)

For example:

- Discuss how market efficiency tests are tests of joint hypotheses.
- Identify issues involved in predicting persistence of market anomalies.
- Describe and apply accounting accruals as potential predictors of ex ante alpha.
- Define price momentum, and recognize its potential role in generating ex ante alpha.
- Define earnings momentum, and recognize its potential role in generating ex ante alpha.
- Define net stock issuance, and recognize its potential role in generating ex ante alpha.
- Define insider trading, and recognize its potential role in generating ex ante alpha.

20.3: Demonstrate knowledge of the Fundamental Law of Active Management (FLOAM). (p. 92)

For example:

- Calculate and interpret the key components (i.e., breadth and the information coefficient) of the FLOAM.
- Describe and determine how the FLOAM can be used to understand changes in the information ratio.
- Recognize trade-offs involved in changing or maintaining the information ratio.
- Define nonactive bets, and recognize their role in the FLOAM.

20.4: Demonstrate knowledge of approaches to implementing anomaly strategies. (p. 94)

For example:

- Recognize methods for integrating anomalies using factor models.
- Define pairs trading, and describe the steps involved in constructing the portfolio.
- Discuss the effect of short selling on reducing risk and increasing alpha.
- Describe the limits to arbitrage and their effect on market efficiency and investment strategies.

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20.5: Demonstrate knowledge of the three major strategies of equity hedge funds. (p. 96)

For example:
- Recognize the mechanics of short selling.
- Describe the key characteristics of short-bias hedge funds.
- Recognize inferences that can be drawn from comparing definable characteristics of short-bias hedge funds with their historical stand-alone and portfolio performance.
- Describe the key characteristics of equity long/short hedge funds.
- Recognize inferences that can be drawn from comparing definable characteristics of equity long/short hedge funds with their historical stand-alone and portfolio performance.
- Describe the key characteristics of equity market-neutral hedge funds.
- Recognize inferences that can be drawn from comparing definable characteristics of equity market-neutral hedge funds with their historical stand-alone and portfolio performance.

20.6: Demonstrate knowledge of risk associated with equity hedge funds. (p. 101)

For example:
- List major types of risk associated with equity hedge funds.

Topic 4.6: Funds of Hedge Funds

21.1: Demonstrate knowledge of the benefits and costs of diversification in hedge fund investing. (p. 106)

For example:
- Define funds of hedge funds.
- Recognize how indices can serve as valuable tools in constructing hedge fund portfolios and analyzing portfolio performance.
- Describe the functions of funds of hedge funds.
- List the benefits to investing in funds of hedge funds.
- List the disadvantages to investing in funds of hedge funds.
- Evaluate how funds of hedge funds add value.
- Discuss and determine the relationship between the number of funds in a portfolio and the level of diversification.
- Describe the process for identifying funds for an institutional portfolio or fund of funds.

21.2: Demonstrate knowledge of investing in multistrategy funds. (p. 110)

For example:
- Evaluate and determine fee-related advantages of multistrategy funds.
- Evaluate flexibility and transparency in the context of multistrategy funds.
- Evaluate potential advantages related to manager selection and operational risk management by funds of funds.

21.3: Demonstrate knowledge of the process of investing in funds of hedge funds. (p. 111)

For example:
- Identify advantages that funds of funds have over direct hedge fund investments.
- Discuss empirical evidence regarding fund of funds returns and the potential for reduced biases in reported performance.

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- Recognize the varying investment objectives of funds of hedge funds.
- Describe how funds of funds can act as venture capitalists.

21.4: Demonstrate knowledge of building a portfolio of single hedge funds. (p. 113)

For example:
- Contrast the fees associated with a fund of funds with those of a portfolio of single hedge funds.
- Discuss costs associated with hedge fund due diligence and minimum investment sizes.

21.5: Demonstrate knowledge of multialternatives and other hedge fund liquid alternatives. (p. 113)

For example:
- Contrast liquid alternatives with a private alternative investment vehicle, such as hedge funds, CTAs, and funds of funds.
- Discuss areas where UCITS regulation is more strict than that for private placements.
- Discuss restrictions on '40 Act funds.
- Compare and contrast relative value hedge funds, event-driven hedge funds, and macro and managed futures funds in the context of the regulatory framework for liquid alternative investments.
- Discuss why multialternatives are popular as liquid alternatives.
- Discuss empirical evidence regarding historical returns of liquid alternatives.

21.6: Demonstrate knowledge of historical performance of funds of hedge funds. (p. 116)

For example:
- Recognize inferences that can be drawn from comparing definable characteristics of market-defensive funds of funds with their historical stand-alone and portfolio performance.
- Recognize inferences that can be drawn from comparing definable characteristics of conservative funds of funds with their historical stand-alone and portfolio performance.
- Recognize inferences that can be drawn from comparing definable characteristics of strategic funds of funds with their historical stand-alone and portfolio performance.
- Recognize inferences that can be drawn from comparing definable characteristics of diversified funds of funds with their historical stand-alone and portfolio performance.

Topic 5: Private Equity

Topic 5.1: Introduction to Private Equity

22.1: Demonstrate knowledge of private equity terminology. (p. 124)

For example:
- Recognize the structure of private equity funds and investments.
- Explain the roles of various entities involved in private equity investments.

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22.2: Demonstrate knowledge of the major forms of private equity investments that involve direct ownership of equity claims. (p. 125)

For example:
- Recognize characteristics of venture capital and its role in business start-ups.
- Discuss the prudent person standard in the context of venture capital.
- Recognize characteristics of buyouts and the role of debt in these transactions.
- Recognize characteristics of merchant banking and the benefits it offers financial institutions.

22.3: Demonstrate knowledge of the major forms of private equity that involve direct ownership of debt securities. (p. 128)

For example:
- Describe mezzanine debt, and explain why it is considered a type of private equity investment.
- Describe distressed debt securities in the context of private equity investing.
- Discuss the growth of the distressed debt marketplace.
- Explain various types of debt covenants.
- Describe leveraged loans in the context of private equity investing.
- Discuss the growth of leveraged loans.

22.4: Demonstrate knowledge of liquid alternatives in the private equity sector. (p. 131)

For example:
- Describe business development companies (BDCs).
- Calculate the premium (or discount) of closed-end fund prices.
- Recognize the effect of illiquidity on closed-end fund pricing.
- Discuss the diversification and return-enhancement potential of liquid private equity pools.
- Discuss other liquid investments in private equity.

22.5: Demonstrate knowledge of trends and innovations in private equity markets. (p. 133)

For example:
- Discuss secondary markets in the context of private equity.
- Explain private investment in public equity (PIPE) transactions, and compare it to other private equity investments.
- Recognize advantages that PIPEs offer investors.
- Recognize and compare various types of PIPEs.
- Discuss hedge fund participation in private equity.
- Contrast private equity funds and hedge funds.

Topic 5.2: Equity Types of Private Equity

23.1: Demonstrate knowledge of the relationships between venture capital and leveraged buyouts. (p. 144)

For example:
- Recognize the role of venture capital and leveraged buyouts as sources of funding for corporations through their life cycle.

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23.2: Demonstrate knowledge of the underlying businesses (portfolio companies) of venture capital. (p. 145)

For example:
- Recognize characteristics of businesses underlying venture capital investment.
- List the types of securities used in venture capital.
- Explain why venture capital investing is similar to purchasing a call option.
- Describe the role of business plans and exit plans in venture capital investment.

23.3: Demonstrate knowledge of venture capital funds. (p. 147)

For example:
- Define a venture capital fund.
- Recognize how venture capital fund managers raise capital.
- Recognize the terms of the partnership agreement of venture capital funds.
- Describe typical venture capital fund fee structures.
- Calculate venture capital fund fees.

23.4: Demonstrate knowledge of the dynamics of investing in venture capital. (p. 149)

For example:
- Describe the stages of the life cycle of venture capital funds and portfolio companies.
- Explain the importance of financing stages in distinguishing among various venture capital funds.
- Explain the compound option that is embedded in most venture capital investments.
- Discuss the concept of the J-curve in the context of a start-up company.

23.5: Demonstrate knowledge of the risk and return characteristics of venture capital investments. (p. 153)

For example:
- Describe the main risks of venture capital investments (i.e., business risk, liquidity risk, and idiosyncratic risk).
- Describe return persistence and vintage-year diversification as keys to successful venture capital investment.
- Recognize inferences that can be drawn from comparing definable characteristics of venture capital investments with their historical stand-alone and portfolio performances.

23.6: Demonstrate knowledge of types of buyout transactions. (p. 154)

For example:
- Distinguish leveraged buyouts (LBOs) from traditional investments.
- Describe a management buyout (MBO).
- Contrast a management buy-in (MBI) with a buy-in management buyout, and describe the agency issues of buyouts.

23.7: Demonstrate knowledge of leveraged buyout (LBO) transactions. (p. 155)

For example:
- Describe the structure of LBO funds and the role of various entities involved in LBO transactions.
- Describe typical LBO fund fee structures.
- Calculate LBO fees.

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- Describe agency relationships, their associated costs, and their role as a potential source of return to LBO transactions.
- Describe general categories of LBO transactions and how they create value.
- Discuss the characteristics of portfolio companies of LBO funds.
- Explain the appeal of a leveraged buyout to managers and investors of the target firm.
- Describe the call-option characteristics embedded in potential payouts of a leveraged buyout.
- Apply the constant growth model to the valuation of a leveraged buyout investment.
- Describe typical exit strategies of LBOs.
- Describe the concept of spillover of corporate governance to the public markets.
- Explain auction markets and club deals as alternatives to the single-sourced approach to funding LBO transactions.
- Discuss why LBO funds tend to have less risk than venture capital funds.

Topic 5.3: Debt Types of Private Equity

24.1: Demonstrate knowledge of mezzanine debt. (p. 170)

For example:

- Describe characteristics of mezzanine debt, including typical exit strategies.
- Analyze how mezzanine debt affects company cost of capital.
- Calculate the weighted average cost of capital structures that include mezzanine debt.
- Compare and contrast mezzanine debt to leveraged loans and high-yield bonds.
- Describe seven typical examples of transactions that use mezzanine debt.
- Describe types of mezzanine debt investors, and recognize their motivations.
- Identify and describe eight characteristics that distinguish mezzanine debt from other types of financing.

24.2: Demonstrate knowledge of distressed debt as a form of private equity investment. (p. 175)

For example:

- Recognize characteristics of distressed debt.
- Discuss the supply of distressed debt.
- Discuss the demand for distressed debt.
- Describe the three typical approaches to distressed debt investment.
- Describe two major types of corporate bankruptcy processes.
- Identify the various terms and standards that relate to bankruptcy processes.
- Discuss business risk in the context of distressed debt investing.

Topic 6: Structured Products

Topic 6.1: Introduction to Structuring

25.1: Demonstrate knowledge of financial structuring. (p. 184)

For example:

- Discuss the relationship between financial structuring and the capital structure of the corporate form of a business organization.

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25.2: Demonstrate knowledge of the major types of structuring. (p. 185)

For example:
- Describe the capital structure of a typical business enterprise.
- Explain how structured products can be used to design a hedge.
- Explain the idea behind tranches.
- Discuss two examples of tailoring structured products.

25.3: Demonstrate knowledge of the primary economic role of structuring. (p. 186)

For example:
- State the primary direct motivation of the issuer.
- Discuss how market completion is a motivation for structuring.
- Define state of the world.
- Discuss how structured products are market completers.

25.4: Demonstrate knowledge of collateralized mortgage obligations (CMOs). (p. 187)

For example:
- Describe the primary difference between CMOs and other investment pools.
- Describe sequential-pay CMOs.
- Calculate cash flows to the tranches of a sequential-pay CMO.
- Define extension and contraction risk.
- Identify and describe other types of CMO structures and tranches (i.e., planned amortization class, targeted amortization class, principal-only, and floating-rate).
- List the two motivations for structured mortgage products.
- Discuss how interest rates and prepayments impact the valuation of a CMO.
- Discuss the role of CMOs in the financial crises of 1994 and 2007.
- Describe commercial CMOs and their default risk.

25.5: Demonstrate knowledge of the structural approach to credit risk modeling. (p. 192)

For example:
- Recognize the optionlike nature of structured cash flows.
- Recognize the intuition of Merton's structural model.
- Apply the call-option and the put-option views of capital structure.
- Discuss the inherent conflict of interest between stockholders and bondholders.
- Define and apply put-call parity.
- Describe how the Black-Scholes option pricing model can be used to estimate the value of debt that contains credit risk.
- Discuss binomial tree models as an alternative to the Black-Scholes option pricing model.
- Discuss advantages and disadvantages of structural credit risk models.

25.6: Demonstrate knowledge of the concept of structuring cash flows using collateralized debt obligations (CDO). (p. 195)

For example:
- Define and explain various tranches of a CDO.
- Discuss attachment points and detachment points.
- Calculate cash flows to different tranches of a CDO in the case of defaults of the underlying instruments.
- Define a bull call spread and a bull put spread.
- Explain the relationship between option spreads, mezzanine tranches, and other tranches.

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Topic 6.2: Credit Risk and Credit Derivatives

26.1: Demonstrate knowledge of credit risk. (p. 206)

For example:
- Explain the underpinnings of credit risk.

26.2: Demonstrate knowledge of approaches to credit risk modeling. (p. 207)

For example:
- Identify the difference between structural models and reduced-form models.
- Define the three factors that determine the expected credit loss of a credit exposure.
- Calculate expected credit loss.
- Describe two key characteristics of the risk-neutral modeling approach.
- Define risk-neutral probability.
- Describe and apply the risk-neutral approach to pricing risky debt.
- Apply the risk-neutral approach to estimating credit spreads.
- Explain what it means to calibrate a model.
- List the advantages and disadvantages of the reduced-form model.
- Compare structural and reduced-form credit risk models.

26.3: Demonstrate knowledge of credit derivatives markets. (p. 213)

For example:
- List and discuss the three economic roles of credit derivatives.
- Recognize the three major methods for grouping credit derivatives.
- Describe the four stages of the evolution of credit derivative activity.

26.4: Demonstrate knowledge of credit default swaps. (p. 216)

For example:
- Compare and contrast credit default swaps and total return swaps.
- Discuss the standard ISDA agreement as a template for negotiated credit agreements.
- Explain and apply the mechanics of credit default swaps.
- Explain the mark-to-market adjustment when valuing credit default swap contracts.
- Explain three methods for unwinding credit default swap transactions.
- Recognize typical credit default swap market participants and their swap transactions.
- Identify and explain five typical motivations for using credit default swaps.

26.5: Demonstrate knowledge of credit options and credit-linked notes. (p. 221)

For example:
- Contrast credit default swaps and credit options.
- Recognize the terminology of credit options.
- Explain the credit put option on a bond.
- Explain call options on credit default swaps.
- Describe credit-linked notes.

26.6: Demonstrate knowledge of credit default swap indices. (p. 223)

For example:
- Describe credit default swap index products.

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26.7: Demonstrate knowledge of the five key risks of credit derivatives. (p. 223)

For example:
- Discuss the risks of excessive credit exposure using off-balance-sheet derivatives, pricing risk of over-the-counter derivatives, and liquidity risk of over-the-counter derivatives.
- Discuss the counterparty risk of over-the-counter credit default swaps and the basis risk of credit default swaps.

Topic 6.3: CDO Structuring of Credit Risk

27.1: Demonstrate knowledge of collateralized debt obligations (CDOs). (p. 234)

For example:
- Describe the history of CDOs.
- Describe the general structure and life cycle of a CDO.
- Explain the terminology and details of CDOs.

27.2: Demonstrate knowledge of balance sheet CDOs and arbitrage CDOs. (p. 236)

For example:
- Discuss the purposes and attributes of balance sheet CDOs.
- Discuss the purposes and attributes of arbitrage CDOs.
- Describe and apply a typical arbitrage CDO structure.
- Analyze the cash flows in a typical arbitrage CDO structure.

27.3: Demonstrate knowledge of the mechanics of and motivations for arbitrage CDOs. (p. 238)

For example:
- Identify the three direct financial motivations for a manager of an arbitrage CDO.

27.4: Demonstrate knowledge of cash-funded CDOs and synthetic CDOs. (p. 239)

For example:
- Compare and contrast cash-funded CDOs and synthetic CDOs.
- Explain how a cash-funded CDO can be used to reduce required regulatory capital.
- Apply a typical cash-funded CDO structure.
- Describe the characteristics of synthetic CDOs.

27.5: Demonstrate knowledge of cash flow and market value CDOs. (p. 242)

For example:
- Describe the characteristics of cash flow CDOs
- Describe the characteristics of market value CDOs

27.6: Demonstrate knowledge of credit risk and enhancement of CDOs. (p. 243)

For example:
- Define and discuss subordination as an internal credit enhancement.
- Discuss and apply overcollateralization.
- Describe excess spread as an internal credit enhancement.
- Discuss reserve accounts as a credit enhancement.
- Describe external credit enhancements to CDOs.

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27.7: Demonstrate knowledge of new developments in CDOs. (p. 245)

For example:
- Describe distressed debt CDOs.
- Describe hedge fund CDOs.
- Describe single-tranche CDOs.

27.8: Demonstrate knowledge of the risks of CDOs. (p. 246)

For example:
- Recognize the risk of the underlying collateral.
- Recognize the financial engineering risk.
- Discuss the implications of high correlations among the underlying assets.
- Define risk shifting, and discuss its implications for CDOs.
- Describe how CDO credit risk can be modeled.

Topic 6.4: Equity-Linked Structured Products

28.1: Demonstrate knowledge of structured products and types of wrappers. (p. 256)

For example:
- Describe equity-linked structured products.
- List distinguishing features of equity-linked structured products.
- Define a wrapper.
- Describe the six types of wrappers.

28.2: Demonstrate knowledge of potential tax effects of wrappers. (p. 257)

For example:
- Describe the tax effects of wrappers.
- Apply the equations in the chapter to demonstrate the tax effects of wrappers.

28.3: Demonstrate knowledge of structured products with exotic option features. (p. 261)

For example:
- Compare and contrast simple options and exotic options.
- Explain principal protected structured products.
- Define the participation rate.
- Illustrate how a cash-and-call strategy is related to put-call parity.
- Identify path-dependent options and binary options.
- Describe and apply barrier, knock-in, and active options.
- Describe the characteristics of in versus out and up versus down barrier options.
- Define spread options and look-back options.
- Define a quanto option.

28.4: Demonstrate knowledge of examples of global structured products. (p. 265)

For example:
- Discuss the example of a U.S.-based structured product with multiple kinks.
- Discuss the example of a France-based structured product with floors.
- Discuss the example of a German-based structured product with leverage.
- Discuss the example of a U.K.-based absolute return structured product.
- Discuss the example of a Swiss-based absolute return structured product.
- Discuss the example of a Japan-based structured product based on multiple currencies.
- Explain the advantages and disadvantages of liquid structured products.

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28.5: Demonstrate knowledge of structured product pricing. (p. 269)

For example:
- Identify the PDE approach to the pricing of structured products.
- Discuss the advantages of the simulation approach over the PDE approach.
- Contrast the PDE approach and the building blocks approach.
- Explain the two principles of payoff diagram shapes and levels.
- Discuss the evidence on structured product prices.

28.6: Demonstrate knowledge of motivations of structured products. (p. 272)

For example:
- Identify investor motivations for including structured products in a portfolio.
- Discuss tax-related motivations for investors.
- Discuss the motivations of issuers of structured products.

Topic 7: Risk Management and Portfolio Management

Topic 7.1: Cases in Tail Events

29.1: Demonstrate knowledge of the effect of market forces in generating hedge fund losses. (p. 279)

For example:
- Discuss the collapse of Amaranth Advisors, LLC; the due diligence issues related to it; and lessons learned from the case.
- Discuss the collapse of Long-Term Capital Management (LTCM), the due diligence issues related to it, and lessons learned from the case.
- Discuss the collapse of Carlyle Capital Corporation, the due diligence issues related to it, and lessons learned from the case.
- Discuss the link between declining investment opportunities and use of leverage.
- Apply the concepts of return on equity, return on assets, and leverage to evaluate levered investment situations.
- Identify and describe behavioral biases and their potential effects on risk taking.

29.2: Demonstrate knowledge of the impact of trading technologies in financial crises. (p. 286)

For example:
- Discuss how the unwind hypothesis and crowded trades explain the Quant Meltdown of August 2007.
- Discuss how a circuit breaker can help prevent a flash crash.
- Discuss how technical issues at one large market participant can impact the financial markets.

29.3: Demonstrate knowledge of major fund failures caused by fraud. (p. 288)

For example:
- Discuss the case of Bayou Management, the due diligence issues related to it, and lessons learned from it.
- Discuss the case of Bernie Madoff, the due diligence issues related to it, and lessons learned from it.
- Discuss the case of Lancer Group, the due diligence issues related to it, and lessons learned from it.

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29.4: Demonstrate knowledge of four major lessons from analysis of fund failures. (p. 291)

For example:
- Discuss the lessons that emerge from the analysis of various types of hedge fund failures.

Topic 7.2: Investment Process, Operations, and Risk

30.1: Demonstrate knowledge of investment strategy and process. (p. 300)

For example:
- Contrast a fund's stated investment strategy and actual investment strategy.
- Contrast style drift with operational errors and fraud.
- Describe the components and stages of the investment process.

30.2: Demonstrate knowledge of investment process and market risk. (p. 302)

For example:
- Contrast the general and narrower definitions of market risk.
- Discuss the causes of investment process risk and how it's detected.
- Describe the relationship between investment process risk and leverage.
- Describe how style drift relates to investment process risk.
- Discuss potential interactions of market risk with other investment risks.

30.3: Demonstrate knowledge of the three internal fund activities. (p. 304)

For example:
- Define investment activities.
- Define operational activities.
- Define business activities.
- Discuss how these three internal fund activities impact a fund in combination.

30.4: Demonstrate knowledge of operational risk. (p. 305)

For example:
- Discuss the two interpretations of operational risk.
- Identify and describe operational errors.
- Identify and describe types of agency conflicts.
- Identify and describe operational fraud.

30.5: Demonstrate knowledge of methods for controlling the operational risk of an investment. (p. 306)

For example:
- Explain how incentives can increase operational risk.
- Discuss how internal control procedures can detect and reduce operational risk.
- Explain the importance of valuation procedures and independence in the valuation process.
- Define custody, and explain how it relates to operational risk.
- Identify and describe the concept of fund culture and how it affects operational risk.

30.6: Demonstrate knowledge of methods for controlling the risk of portfolios with options. (p. 309)

For example:
- Describe how put-call parity can be applied to hedge a position.

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- Discuss how option sensitivities can be used to analyze and hedge a position or portfolio.
- Discuss how options can be used as a bet on volatility.

Topic 7.3: Due Diligence of Fund Managers

31.1: Demonstrate knowledge of due diligence evidence and organization. (p. 318)

For example:
- Identify evidence for and organization of a due diligence process.

31.2: Demonstrate knowledge of the three questions critical to understanding the nature of a manager's investment program. (p. 319)

For example:
- Define and describe due diligence processes related to investigation of investment objectives of hedge funds.
- Define and describe due diligence processes related to investigation of investment processes of hedge funds.
- Define and describe due diligence processes related to investigation of how hedge fund managers add value.
- Describe and contrast information gathering and information filtering.

31.3: Demonstrate knowledge of the due diligence of hedge fund structures. (p. 321)

For example:
- Describe the main issues related to the review of a fund's organization.
- Discuss the master trust account structure, and recognize its uses by hedge funds.
- Explain the importance of reviewing fund managers' organizational structures.
- Discuss separation of duties and how organizational charts can be used to evaluate it.
- Recognize the importance of reviewing and documenting regulatory registrations.
- Describe evaluation and documentation of outside service providers, including the auditor, attorneys, and the prime broker.

31.4: Demonstrate knowledge of the strategic review of fund managers in the due diligence process. (p. 324)

For example:
- Explain the importance of understanding the markets and securities in which a manager invests.
- Discuss the issues related to benchmarking of fund returns.
- Describe key considerations in the analysis of managers' competitive advantages and sources of investment ideas.
- Describe key considerations in the review of managers' current portfolio positions.
- Describe key considerations in the review of the source of investment ideas.
- Discuss investment strategy capacity in the context of evaluating structural risk.

31.5: Demonstrate knowledge of the administrative review of funds. (p. 327)

For example:
- Discuss the importance of due diligence on the ethical and legal history of fund employees.

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- Discuss the reasons for review of employee turnover.
- Discuss the ideal organization of investor relations.
- Describe the importance of business continuity management.

31.6: Demonstrate knowledge of the procedure for conducting a performance review of a fund manager in the due diligence process. (p. 328)

For example:
- Describe the behavioral biases that can interfere with performance analysis.
- Identify and discuss three important questions to ask regarding all assets controlled by the fund manager.
- Discuss the analysis of drawdowns.
- Identify and discuss the five issues related to the use of past data to predict future performance.
- Describe how the analysis of returns can be impacted by the investment horizon.
- Discuss issues related to subscriptions, redemptions, and volatility of assets under management.
- Describe considerations in the review of the asset manager's process for pricing securities in a portfolio.

31.7: Demonstrate knowledge of the procedure for conducting a portfolio risk review of a fund manager in the due diligence process. (p. 332)

For example:
- Identify and discuss three important risk management questions.
- Describe and apply the role of leverage in determining the total risk of a fund.
- Discuss the role of the chief risk officer (CRO).

31.8: Demonstrate knowledge of the procedure for conducting a legal review of a fund manager in the due diligence process. (p. 334)

For example:
- Discuss considerations in the review of the fund structure.
- Discuss considerations in the review of the fund fees.
- Discuss considerations in the review of the lockup and redemption provisions, including gates and hard and soft lockup periods.
- Discuss considerations in the review of the subscription amount.
- Discuss the role of the advisory committee.

31.9: Demonstrate knowledge of the procedure for conducting reference checks on service providers and other fund investors. (p. 336)

For example:
- Discuss the process of conducting reference checks on service providers.
- Identify key questions to ask when conducting reference checks on other investors.

31.10: Demonstrate knowledge of the procedure for measuring operational risk. (p. 337)

For example:
- Discuss the role of the omega score in measuring operational risk.
- Discuss the cost of fund manager due diligence.

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Topic 7.4: Portfolio Management, Alpha, and Beta

32.1: Demonstrate knowledge of smart beta strategies. (p. 347)

For example:
- Recognize the distinguishing characteristics of smart beta strategies from active alpha-based strategies.
- Describe the objectives of smart beta strategies.
- Discuss how smart beta strategies can be used in portfolio management.

32.2: Demonstrate knowledge of factors involved in the estimation of alpha and beta. (p. 348)

For example:
- Understand the challenges of estimating alpha and beta.

32.3: Demonstrate knowledge of the concept of separating alpha and beta. (p. 349)

For example:
- Describe the concept of separation of alpha and beta.

32.4: Demonstrate knowledge of portable alpha. (p. 349)

For example:
- Demonstrate how to transfer risk with appropriately-sized positions in derivatives.
- Apply the concept of notional value to determine futures positions designed to transfer risk.
- Discuss the application of portable alpha using futures contracts.
- Apply the concept of portable alpha to portfolio management.
- Discuss challenges with porting alpha.

32.5: Demonstrate knowledge of asset allocation using the concepts of alpha and beta. (p. 354)

For example:
- Describe the process of traditional asset allocation.
- Explain strategic and tactical asset allocation.
- Describe the new investment model.
- Discuss active risk and active returns for traditional investment products.
- Evaluate the proposition that alpha is a zero-sum game.

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The following is a review of the Hedge Funds principles designed to address the learning objectives set forth by the CAIA Association®.

Structure of the Hedge Fund Industry

Topic 4.1

Exam Focus

This topic review begins by exploring the characteristics of hedge funds, the history of the hedge fund industry, and the different types of hedge fund structures and investment strategies. While management and incentive fees may attract top talent to a fund, we examine how perverse incentives may encourage managers to act in a manner that is not in the best interest of investors. Understand how optimal contracting and managerial coinvesting are used to reduce perverse incentives and excessive conservatism. Know the implications of both the option view and annuity view of incentive fees. Understand the conclusions of empirical studies with regard to managers' behavior and incentive fees. Know the four primary hedge fund investment strategies. Be familiar with characteristics that indicate hedge fund investments expand the investment opportunity set for investors. Finally, know what types of hedge fund indices exist and their limitations.

Characteristics of Hedge Funds

LO 16.1: Demonstrate knowledge of the distinguishing features of hedge funds and their growth and concentration over time.

For example:

- **Identify and describe the three primary elements of hedge funds.**
- **Recognize the six investment flexibilities offered by hedge funds.**
- **Discuss the reasons for hedge fund industry growth and concentration.**
- **Recognize events that led to the trend of consolidation within the hedge fund industry.**

Primary Elements of Hedge Funds

Hedge funds are pools of investments that provide alternative investment opportunities that go beyond traditional investments. Hedge funds differ from traditional investments with respect to regulatory structures, compensation structures, and trading structures.

- *Regulatory structures*. Hedge funds are privately organized and generally unlisted. Because they are privately organized, hedge funds are not heavily regulated. Hedge funds fall within the **safe harbor** exemptions of the Investment Company Act of 1940. This means that hedge funds do not have to deal with the filing, disclosure, record keeping, and various reporting requirements to which mutual funds must adhere. However, the safe harbor exemptions prevent hedge funds from raising capital in a public offering.

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Hedge funds are much more restricted than mutual funds in allowing investors to invest in their funds. Investors in hedge funds are primarily wealthy individuals (i.e., accredited investors or qualified purchasers), foundations, endowments, pension funds, and other institutions.

- *Compensation structures.* Hedge funds offer managers performance-based incentive fees that attract elite managers with more sophisticated strategies.
- *Trading structures.* Hedge funds are unrestricted in terms of investment strategies, concentration limits, use of leverage, and use of derivatives. Conversely, mutual funds are restricted in all of these areas. Hedge funds can be managed with more flexibility in six ways. Hedge funds are able to:
  1. Invest in private securities and real assets.
  2. Use leverage, sometimes in high amounts.
  3. Use derivatives, including long or short futures positions and buying or writing options.
  4. Sell securities short.
  5. Invest in structured products and other nontraditional securities.
  6. Use complex active management strategies and dynamic risk exposures.

Hedge Fund Industry Growth and Concentration

Due to its private nature, the exact size of the hedge fund universe is unknown. However, it is estimated that the hedge fund industry grew dramatically from $500 billion in assets in 2000 to $2.8 trillion in assets in 2014. The long-term growth trend for hedge funds is the result of their favorable investment attributes, which include:

- Low correlations with traditional investments that provide diversification benefits to investors.
- The ability of hedge funds to hold both long and short positions.
- The potential for larger returns than traditional investments.

The financial crisis that began in 2007 led to massive hedge fund liquidations. Several prominent hedge fund frauds and fund liquidations occurred in 2008. This trend led to a **consolidation** as smaller participants exited the market and large firms became even larger. Increased due diligence requirements and their financial cost contributed to the consolidation trend as larger firms were better able to build the needed infrastructure that many investors demanded. In 2014, the largest 25% of hedge fund firms had 94% of the industry's assets under management. This indicates a clear institutional investor preference for large hedge funds.

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Hedge Fund Fees

LO 16.2: Demonstrate knowledge of hedge fund fees.

For example:

- **Recognize typical hedge fund fee arrangements.**
- **Calculate annual hedge fund fees.**
- **Describe and apply high-water marks (HWMs) and hurdle rates.**
- **Discuss the potential effects of incentive fees on hedge fund manager behavior.**
- **Recognize and apply the annuity view of hedge fund fees.**
- **Recognize and apply the option view of incentive fees and its implications on manager behavior.**
- **Describe the empirical evidence regarding hedge fund fees and managerial behavior.**

Hedge fund fee structures consist of a management fee based on assets under management (AUM) and a performance fee:

- **Management fees** are collected on a quarterly, semiannual, or annual basis and are collected regardless of fund performance. The typical management fee for a hedge fund is 2% of AUM, but management fees may range from 1% to 3%.
- **Performance fees** (also known as *incentive fees* or *profit-sharing fees*) are collected on an annual basis, but only if the fund is profitable. The typical performance fee is 20%, but performance fees may go as high as 40%. If the management fee is 2% and the performance fee is 20%, the fee structure would be referred to as "2 and 20," which is one of the most common hedge fund fee structures.
- Competitive forces have put downward pressure on hedge fund fees. In 2014, the average management fee was 1.5% for single-manager funds and 1.25% for funds of funds, while incentive fees averaged 18% for single-manager funds and 7% for funds of funds.
- Fund compensation agreements may contain a **high-water mark provision** under which the incentive fee will only be paid if the net asset value (NAV) is above the maximum previously observed NAV (i.e., the high-water mark).
- Fund compensation agreements may also contain a **hurdle rate**, where the incentive fee will only be paid if the fund return exceeds a set threshold return (e.g., 4%).

The total annual fee as a percentage of AUM is expressed as:

$$\text{annual fee} = \text{mgt fee\%}(NAV_{beg}) + \{\max[0,(\text{incentive fee \%}) \times (GR - \text{mgt fee} - \text{hurdle})]\}$$

where:

NAV_{beg} = NAV at the beginning of the year
GR = gross return above HWM

Example: Calculating Ending NAV After Fees

ABC Hedge Fund has a 2 and 25 fee arrangement with no hurdle rate and an NAV of $250 million at the beginning of the year. The NAV increased to $295 million at the end of the year, before fees. If management fees are distributed annually based on the start-of-the-year NAV, **calculate** the following:

1. Annual management fee.

2. Incentive fee.

3. Total annual fee.

4. Ending NAV after fees.

Answer:

1. Annual management fee = 2% × $250 million = $5 million

2. The incentive fee is calculated by multiplying the incentive percentage fee of 25% by the profit less the annual management fees, as follows:

   incentive fee = 25% × ($295 million – $250 million – $5 million) = $10 million

3. Total annual fee = management fee + incentive fee = $5 million + $10 million = $15 million

4. Ending NAV after fees = $295 million – $5 million – $10 million = $280 million

$$\text{percentage return (after fees)} = \frac{\$280 \text{ million} - \$250 \text{ million}}{\$250 \text{ million}} = 12\%$$

We can also calculate the fees if we are given after-fee NAVs as seen in the following example.

Example: Calculating Ending NAV Before Fees

XYZ Hedge Fund has a 1 and 20 fee arrangement with no hurdle rate and an NAV of $500 million at the beginning of the year. The NAV increased to $600 million at the end of the year, after fees. If management fees are distributed annually based on the start-of-the year NAV, **calculate** the following:

1. Annual management fee.

2. Incentive fee.

3. Total annual fee.

4. Ending NAV before fees.

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Answer:

1. Annual management fee = 1% × $500 million = $5 million

2. The incentive fee is calculated by using the percentage of the profits that the general and limited partners receive as well as the after-fee profit to the limited partners:

   incentive fee = (20% / 80%) × ($600 million – $500 million) = $25 million

3. Total annual fee = management fee + incentive fee = $5 million + $25 million = $30 million

4. Ending NAV before fees = $600 million + $30 million = $630 million

High-Water Marks, Hurdle Rates, and Fees

The **high-water mark** (HWM) is the highest NAV that incentive fees were based on for the fund. If incentive fees are calculated based on the end-of-year NAV, then the HWM corresponds to the highest end-of-year NAV. The NAV fluctuates over time and is often greater at some point during the year than at the year-end. The HWM is designed to ensure incentive fees are paid only once on each dollar of cumulative net profit to the fund.

Figure 1: Fee Calculations With HWM and Hurdle Rates

Panel A: 2% Management Fee, 20% Incentive Fee, and **0% Hurdle Rate**

FYE	*Gross Return*	*Incentive Fee % of AUM*	*Total Fee*	*Net Return*	*Beg NAV*	*End NAV*	*End HWM*
20X5	6.0%	0.80%	2.80%	3.20%	200.0	206.4	206.4
20X6	6.0%	0.80%	2.80%	3.20%	206.4	213.0	213.0
20X7	20.0%	3.60%	5.60%	14.40%	213.0	243.7	243.7
20X8	–10.0%	0.00%	2.00%	–12.00%	243.7	214.4	243.7
20X9	15.0%	0.00%	2.00%	13.00%	214.4	242.3	243.7

Panel B: 2% Management Fee, 20% Incentive Fee, and **4% Hard Hurdle Rate**

FYE	*Gross Return*	*Incentive Fee % of AUM*	*Total Fee*	*Net Return*	*Beg NAV*	*End NAV*	*End HWM*
20X5	6.0%	0.00%	2.00%	4.00%	200.0	208.0	208.0
20X6	6.0%	0.00%	2.00%	4.00%	208.0	216.3	216.3
20X7	20.0%	2.80%	4.80%	15.20%	216.3	249.2	249.2
20X8	–10.0%	0.00%	2.00%	–12.00%	249.2	219.3	249.2
20X9	15.0%	0.00%	2.00%	13.00%	219.3	247.8	249.2

The example illustrated in Figure 1 details the calculation of total fees and ending NAV, assuming a 2% management fee, a 20% incentive fee, and an HWM provision. In Panel A, there is a 0% hurdle rate, while Panel B assumes a 4% hard hurdle rate. Notice that for every year the ending NAV reaches a new high, the ending HWM is set to that level. No incentive fees are paid for years when the ending NAV is less than or equal to the HWM.

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Thus, incentive fees are only paid once on each dollar of cumulative net profit to the fund. With a 0% hurdle rate in Panel A, there was an incentive fee of 0.8% for 20X5 and 20X6 [calculated as 20% × (6% – 2% – 0%) = 0.8%]. Notice that in years 20X8 and 20X9 no incentive fee was paid, regardless of the hurdle rate, because the HWM was greater than the ending NAV.

In Panel B, the hurdle rate of 4% lowers the total fees paid to the hedge fund manager. The hurdle rate is a minimum return that must be earned before an incentive fee is paid to the manager. With a 4% hurdle rate, no incentive fees were paid for 20X5 and 20X6.

Incentive Fees Effects

Incentive fees may result in perverse incentives. A **perverse incentive** motivates the hedge fund manager to manage the fund in his own best interest rather than the best interests of investors. For example, the hedge fund manager may be influenced by the relative value of the fund's NAV and HWM and seek increased volatility. Perverse incentives may be less of an issue if a manager holds a substantial personal investment in his own fund. According to research done by Kouwenberg and Ziemba (2007), risk taking in a hedge fund is reduced if the manager's personal stake in the fund exceeds 30%.[1]

Incentive fees, especially the **asymmetric incentive fees** (i.e., the manager earns a percentage of gains but is not required to pay a percentage of losses) that are typical for hedge funds, may encourage managers to take more risk. This is the main reason why the '40 Act in the United States prohibits traditional mutual funds from charging asymmetric incentive fees.

Optimal contracting refers to designing incentive fees with the intent to align the interest of managers and investors. However, the marginal benefits must outweigh the marginal costs. Differences in risk tolerance, diversification, and other factors may make this difficult to achieve.

Some researchers suggest **managerial coinvesting** is an effective way to enhance alignment. Under the framework of managerial coinvesting, managers invest a portion of their own money in the fund with the anticipation that this will provide added incentive to the manager to increase returns and control risk. However, coinvesting can lead to **excessive conservatism** by the hedge fund manager because the manager's total income and total wealth are very sensitive to the fund's performance.

Viewing Fees as Annuities

The following example illustrates the manager's incentive to maintain profitability by analyzing the annuity view of hedge fund fees. The **annuity view of hedge fund fees** refers to the stream of cash flows in the form of hedge fund manager fees.

Assume Fund X has a beginning NAV of $400 million and earns a constant 17% rate of return with no additional capital invested in the fund. Management and incentive fees are 2% and 20%, respectively.

At the end of year 1, Fund X will have an NAV of $468 million before fees (= $400 × 17%). The management fee for year 1 is $8 million (= 2% × $400). The incentive fee for year 1 is $12 million [= 20% × ($68 – $8)]. The NAV at the end of year 1 will be $448 (= $400 + $68 – $8 – $12).

[1] Kouwenberg, Roy and Ziemba, William T., "Incentives and Risk Taking in Hedge Funds". Journal of Banking and Finance, Vol. 31, No. 11, 2007.

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At the end of year 2, Fund X will have an NAV of $524.16 million before fees (= $448 × 1.17). The management fee for year 2 is $8.96 million (= 2% × $448). The incentive fee for year 2 is $13.44 million [= 20% × ($76.16 – $8.96)]. The NAV at the end of year 2 will be $501.76 million (= $448 + $76.16 – $8.96 – $13.44).

Suppose Fund X is liquidated at the end of year 2. Using a 17% discount rate, the present value of the ending NAV is $366.54 million [= $501.76 / $(1.17)^2$].

The total present value of management fees is $33.46 million (= $400 beginning NAV – $366.54 ending NAV).

Fund X's investors received a 12% return from investing $400 million for two years and receiving a $501.76 million payout in year 2 (12% is the IRR for this 2-year investment). Figure 2 summarizes the results if this example is extended out to 500 years with a constant 17% return, 0% hurdle rate, 2% management fee, and 20% incentive fee.

Figure 2: Present Value of Fund Manager Fees With Constant 17% Return on Fund X

Year	*1*	*2*	*5*	*10*	*25*	*100*	*500*
	4.3%	8.4%	19.6%	35.4%	66.4%	98.7%	100.0%

Figure 2 illustrates how manager fees increase over time. The key factor driving the magnitude of the results is the fact that fees are distributed annually while profits are reinvested. This allows managers to collect fees on reinvested earnings. This illustrates the incentive for hedge fund managers to earn large returns. It also illustrates the value of staying in business over a long period by earning fees on reinvested profits.

A manager may be encouraged to take excessive risks if the fund's NAV falls significantly below the HWM. In this situation, the manager may not expect to earn incentive fees in the near term unless the firm's risk is increased. The managers are also encouraged to increase risks because they earn incentive fees on large returns without being liable for losses. Thus, the uncertainty of the fund's returns can dramatically affect the behavior of hedge fund managers.

Viewing Fees as Options

The **option view of incentive fees** demonstrates the ability of hedge fund managers to increase the present value of their fees by increasing the volatility of the fund's assets. Hedge fund performance fees are considered a *free call option* (i.e., an incentive fee option) granted to the fund managers on an annual basis. The payout function for the performance fee option can be expressed as follows:

$$\text{incentive fee payout} = \max[i(NAV_{end} - NAV_{beg}),0]$$

where:

i = incentive fee percentage
NAV_{end} = NAV at end of period
NAV_{beg} = NAV at beginning of period

Professor's Note: This formula is the basic European call option payout function adjusted to reflect performance fee inputs. The strike or exercise price in the formula is the beginning of period NAV unless it is below the high-water mark, in which case the high-water mark serves as the strike price. The maturity or expiration of the incentive fee option is one year.

If the hedge fund is out of the money at the end of the year (NAV is below its HWM), then the manager receives no incentive fee. If the hedge fund is in the money at the end of the year, the hedge fund manager exercises the option by collecting the incentive fee.

The **incentive fee option value** can be expressed using the Black-Scholes option pricing model. Five factors affect the value of an option on performance fees. These factors and their effect on the performance fee option value (holding all other inputs constant) are as follows:

- *Strike price (higher of beginning NAV or HWM)*—An increase in beginning NAV will decrease the performance fee option value (i.e., negative relationship). Note that if there is a hurdle rate, the strike price is the future value of the NAV using the hurdle rate.
- *Current NAV*—An increase in current NAV will increase the performance fee option value (i.e., positive relationship).
- *Risk-free interest rate*—An increase in the risk-free interest rate will increase the performance fee option value (i.e., positive relationship).
- *Volatility of NAV (standard deviation of fund's NAV)*—An increase in NAV volatility will increase the performance fee option value (i.e., positive relationship).
- *Performance fee percentage*—An increase in the performance fee percentage will increase the performance fee option value (i.e., positive relationship).

Professor's Note: Because the LO does not specifically ask you to calculate option value using the Black-Scholes formula, it is unlikely you would need to perform all of the complicated calculations in the formula.

A simpler approach to estimating the incentive fee call option value is the **at-the-money incentive fee approximation:**

$$\text{incentive fee call option value} = i \times 40\% \times \text{NAV} \times \sigma_1$$

where:
i = incentive fee percentage
σ_1 = volatility

As its name suggests, this approximation assumes the incentive fee call option is at the money. It also assumes very low interest rates.

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Example: Calculating the option value of incentive fees

Suppose a $400 million hedge fund has a 20% incentive fee. In addition, assume there is no hurdle rate or HWM. Thus, at the beginning of the year, the incentive fee option is reset at the money.

Calculate the incentive fee call option value:

1. If the annual volatility of the NAV is 10%.

2. If the annual volatility of the NAV is 20%.

Answer:

1. Incentive fee call option value = (20%)(40%)($400 million)(10%) = $3,200,000

2. Incentive fee call option value = (20%)(40%)($400 million)(20%) = $6,400,000

This approximation demonstrates the influence volatility has on the value of the manager's incentive fee.

The optionality of performance fees has two major effects on the behavior of hedge fund managers:

1. *Managers have an incentive to increase the NAV volatility because volatility is positively related to the value of a call option.* In effect, managers have an asymmetric payoff pattern while investors have a symmetric payoff pattern.

2. *When the option is far out of the money, the manager will be motivated to increase the volatility of the fund's strategy in an attempt to bring the option into the money or to attempt to renegotiate the incentive structure.* If the fund NAV is well below the high-water mark, the manager might attempt to negotiate a lower high-water mark or may close the fund and open a new fund to establish a new lower high-water mark.

The Influence of Fees on Managers

Both theoretical and empirical analyses suggest managers may not act in the best interest of investors due to perverse incentives.

The annuity view of hedge fund fees implies large fees to managers that are able to sustain long-term growth in AUM. Managers whose primary focus is increasing AUM are known as **pure asset gatherers**. Because these managers take little risk, their returns often are highly correlated with index returns. Hedge fund managers that charge high fees but actually are passive managers that track index returns are known as **closet indexers**. These managers are able to generate high levels of management fees due to their high AUM but fail to provide the active management typically expected with these fees. Incentive fees help motivate managers to take the risks required to achieve above-average returns. The option view of hedge fund fees implies managers can realize large gains in one-year periods by increasing the volatility of the NAV.

Empirical studies have found evidence that fund managers take more risks when the NAV is far out of the money. They also find managers take less risk to preserve their incentive

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fees when the incentive option is far in the money and refer to this behavior as the **lock-in effect**. There is also some evidence of **managing returns** and **massaging returns**, which suggests managers alter returns higher towards preferred targets in the month of December.

Although hedge fund managers have an incentive to increase fund volatility due to the increase in incentive option value, the fund managers may have several offsetting incentives. Factors that limit a manager's desire to increase volatility include:

1. The manager may have his own money invested in the fund.

2. Poor performance will drive the NAV further below the high-water mark, lowering the probability that the manager will collect future performance fees.

3. Poor performance may lead to investors pulling capital out of the fund, which will reduce assets under management and the management fee.

4. The manager's reputation could be damaged by poor performance.

Classifying Hedge Funds

LO 16.3: Demonstrate knowledge of various types of hedge funds.

For example:
- **List hedge fund strategies.**
- **Contrast single-manager hedge funds, funds of funds, and multistrategy funds.**

Hedge Fund Strategies

Figure 3 summarizes the five CAIA classifications of hedge funds based on strategies. The classifications are organized groups and labels based on trading strategies that underlie their performance. The first four categories in Figure 3 are **single-manager hedge funds**. The last category, **funds of funds (FOFs)**, predominantly consists of investments in other hedge funds. We will extensively examine all of these fund strategies in later topic reviews.

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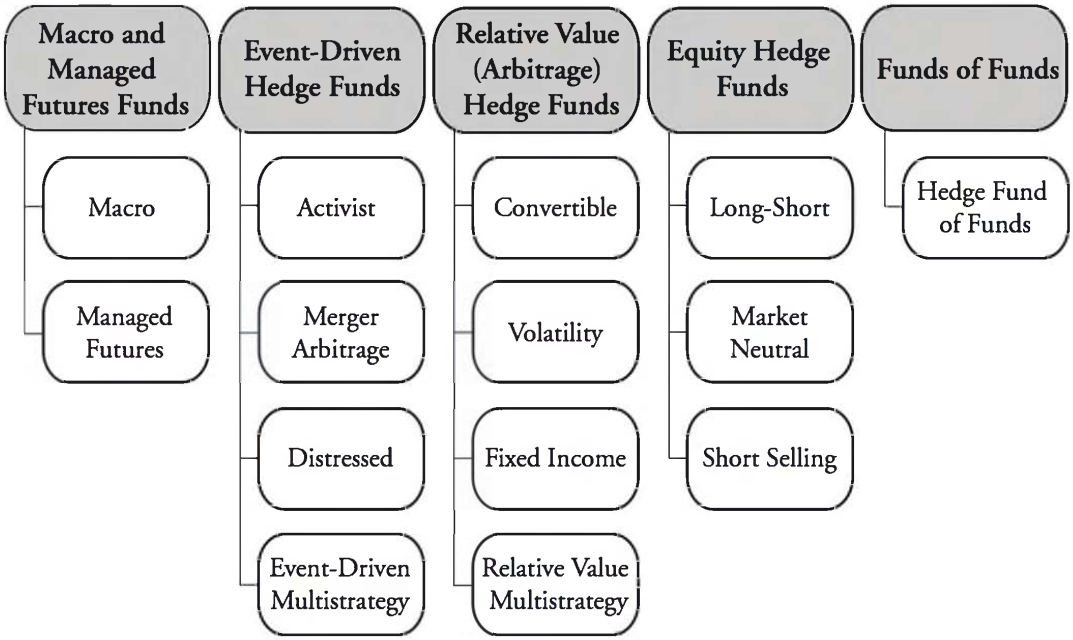
Figure 3: Five CAIA Classifications of Hedge Fund Strategies



Hedge Fund Types

The analogy of single stocks to mutual funds can be used to understand the relationship of single-manager funds to FOFs. **Single-manager funds** have underlying investments that do not consist of other hedge funds. **Funds of funds** invest in a diversified group of single-manager funds. In that sense, FOFs are similar to mutual funds that invest in a diversified group of individual stocks.

A **multistrategy fund** is a single-manager hedge fund with investments that include a variety of strategies. There is a single layer of fees to compensate the submanagers of the different strategies that are all part of the same organization. In contrast, a FOF adds on a second layer of fees to compensate the manager for portfolio construction, monitoring, and oversight.

When examining fund types, it is important to note that single-manager funds have a higher level of **fund mortality** than multistrategy funds or funds of funds. Fund mortality refers to the number of hedge funds that shut down and liquidate their investment portfolios. As of the second quarter of 2014, more than 7,700 hedge funds had been liquidated since 2006, while over 9,700 hedge funds had been liquidated since 1996. The actual number of hedge fund liquidations is higher because these numbers only reflect hedge funds that report to Hedge Fund Research, Inc. (HFR). These numbers reflect the risk of investing in an individual hedge fund. HFR estimated that only 50% of the hedge funds that were in operation in 2010 were over five years old, and the average fund lifespan was 4.4 years. Not surprisingly, hedge funds with larger levels of assets under management and lower volatility had longer lifespans relative to other funds.

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Hedge Fund Strategies

LO 16.4: Demonstrate knowledge of various hedge fund strategies.

For example:

- Identify and describe equity strategies.
- Identify and describe event-driven and relative value strategies.
- Identify and describe absolute return strategies.
- Identify and describe diversified strategies.

Portfolio managers should understand the risks and underlying return distributions of hedge funds prior to including them in a portfolio. Different hedge fund strategies have different non-normal distributions that suggest benefits of diversifying across funds and strategies. FOF managers invest in a portfolio of other hedge funds. The role of the FOF manager is that of a tactical asset allocator. The manager takes a tactical asset allocation approach by allocating to various hedge fund strategies or managers that the FOF manager believes have the best opportunity for return in the current market environment.

The primary advantage of using FOFs is diversification. By diversifying assets across multiple hedge fund managers or strategies, the risk from any one manager can be reduced or eliminated. Diversification also results in less-volatile returns.

Based on historical performance, the three primary advantages of FOFs are:

1. FOFs reflect the actual returns of a diversified investor in hedge funds.

2. FOF databases are less biased than individual hedge funds.

3. The net performance of FOFs is net of the cost of due diligence and portfolio construction. Investors in individual hedge funds must bear these costs, which are not reflected in individual hedge fund returns.

Depending on the text you may read, you will see that there are many different ways of classifying hedge funds. However, for the purpose of the CAIA curriculum, there are four broad categories of hedge fund strategies used for portfolio allocation and systematic risk management purposes.

1. **Equity strategies** have some degree of systematic (i.e., market) risk exposure, which means that the fund is impacted by movements in the financial markets. Hedge funds that fall into this category include equity hedge (i.e., equity long/short) and short bias funds.

2. **Event-driven strategies** and **relative value strategies. Event-driven strategies** take positions based on some event that has occurred or is likely to occur. These can include event-driven multistrategy, distressed securities, and merger arbitrage strategies. **Relative value strategies** (also known as **convergent strategies**) take positions based on differences between security prices that are expected to converge. These can include relative value multistrategy, convertible, volatility, and fixed income strategies.

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3. **Absolute return strategies** attempt to earn positive returns regardless of the direction of the financial markets. Absolute return programs allow investors to achieve improved risk/return performance by capturing the benefits of fund diversification. Hedge funds that fall into this category include equity market neutral funds and market defensive FOFs. Absolute return products contrast sharply with **relative return products** (e.g., mutual funds) that should be evaluated based on their risk/return performance relative to the market or some index.

4. **Diversified strategies** diversify across different investment themes. Hedge funds that fall into this category include global macro funds, systematic diversified funds, multistrategy funds, and FOFs.

Equity Strategies

Market-directional hedge funds have some degree of systematic risk exposure, suggesting that the funds are impacted by movements in the financial markets. For example, consider a long/short hedge fund that has the ability to go 140% long in stocks that the manager believes are undervalued and 80% short in stocks that the manager believes are overvalued. The fund's net market exposure is 60% long, but its exposure to stock selection by the fund manager is 220%.

Short-bias funds hold nearly all stock positions in a short position, and thus have a negative correlation with equity market returns, but may vary their short exposure in response to market conditions. While these funds underperform the equity market over a full cycle, they are useful for risk reduction during market downturns and may generate significant alpha through stock selection.

Event-Driven and Relative Value Strategies

Event-driven and relative value hedge fund strategies have historically had the lowest standard deviations, the largest negative skewness, and the largest excess kurtosis of all the hedge fund categories. Their returns historically are similar to the insurance industry, reflecting small profits for the majority of time periods with occasional large losses in a relatively short period of time. For example, the merger arbitrage strategy had profits in the range of 0–2% in 75% of the months studied. Thus, they exhibit consistent small profits and lower standard deviations than world equities. However, their large negative skewness and excess kurtosis suggest large outlier months when they incur significant losses.

Event risk is essentially **off-balance-sheet risk** that is not reflected in financial statements. The primary source of return for event-driven strategies results from the accurate prediction of the occurrence of an event. In addition, the transaction must occur within the expected time frame. The primary risk involved with event-driven strategies is event risk. If the event does not occur as expected or within the expected time frame, the strategy is likely to fail.

Event-driven strategies attempt to profit from mispricings associated with one-time, company-specific events. Event-driven strategies encompass both merger arbitrage and distressed securities strategies. Event-driven strategies are more broadly defined, allowing them to take advantage of any capital market event. These events are non-recurring, often involve large transactions values, and have the potential for inefficiencies that create profit opportunities. Event-driven strategies are subject to deal risk because many of the transactions are contingent upon uncertain shareholder or regulatory approvals. The main

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source of return is from the accurate prediction of the occurrence of an event within the given time frame of the investment.

Short volatility exposures refer to the sale of options or event-related arbitrage strategies. These short event-related arbitrage strategies involve risk exposures that cause losses when asset return volatilities increase. During normal market time periods, short volatility exposure strategies collect small profits. However, when an unexpected event occurs, such as a failed merger or failed corporate spin-off, these strategies can incur sizeable losses.

For example, a merger arbitrage hedge fund manager would have both a long and short position with respect to the target and acquiring firm. This short volatility strategy will not show up on the balance sheet, but investors should understand these risks exist. Three risk management techniques can help reduce the risk for investors in merger arbitrage funds:

1. Diversify with several merger arbitrage funds.

2. Diversify across industries and market capitalization size.

3. Limit the amount of leverage the merger arbitrage hedge fund manager is allowed to use.

Another example of event risk is illustrated by a relative value strategy implemented by **Long-Term Capital Management** (LTCM). LTCM was a hedge fund founded in 1994 by executives from Salomon Brothers and several well-known financial academics. LTCM followed several relative value strategies including volatility arbitrage and fixed-income arbitrage. After several years of successful returns, LTCM experienced enormous growth and had positions in equity, fixed income, and derivative markets around the world. At the beginning of 1998, LTCM had $125 billion of assets with a capital base of $4.8 billion, implying a leverage ratio of 28 to 1. However, many of LTCM's investments were in derivative positions that had their own economic leverage. Accounting for LTCM's total economic leverage, it had positions representing notional principal of over $1 trillion for a leverage ratio of almost 300 to 1. The astronomical use of leverage was possible because financial institutions often waived margin requirements based on the reputation of the principals, freeing up capital to take on more leverage.

In August of 1998, Russia unexpectedly defaulted on its debt, sending Russian interest rates soaring to 200% and crushing the value of the ruble. This economic shock triggered investor concern about already faltering economies in the Pacific Rim, causing the yields on developing nations' debt to increase and a flight to the quality of government bonds in industrialized countries. Yields on corporate debt—high- and low-quality—also increased sharply. In other words, the flight to quality increased rather than decreased credit spreads, causing huge losses for LTCM. Shortly thereafter, Brazil also devalued its currency, thereby increasing interest rates and risk premiums further. The general increase in volatility also generated losses in LTCM's equity volatility strategies.

Although prices in relative value arbitrage strategies sometimes diverge and create temporary losses before they ultimately converge, the large increase in yield spread created huge losses and severe cash flow problems caused by realizing marked-to-market losses and meeting the resultant margin calls. The effects of the losses and the cash flow crisis were compounded by the LTCM's hyper leverage. LTCM lost 44% of its capital in August 1998 alone. In September of that year, a consortium of banks made a capital infusion to LTCM in order to avert a global financial crisis.

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Event-risk and relative-value hedge funds are like insurance companies or option writers who make small profits over time as long as a major, unfavorable event does not occur. The LTCM case provides an example of the risk associated with extreme amounts of leverage and the private nature of hedge fund strategies. Therefore, an effective risk management tool is to invest only in hedge funds with limited leverage.

Absolute Return Strategies

Absolute return hedge fund strategies attempt to earn consistent, positive returns regardless of the direction of the market. Hedge fund managers claim that they have the ability to achieve absolute returns because they follow a skill-based investment process, meaning that returns depend on the manager's skill at selecting specific securities rather than the performance of a broader asset class. Absolute return hedge funds tend to have very small skew (positive or negative) and low leptokurtosis. They can even exhibit platykurtosis where the tails of the distribution are thinner than the normal distribution.

Hedge fund investors may choose to construct an *absolute return program* to take advantage of the benefits of hedge fund diversification. In this program, an investor would invest in multiple hedge funds. A range of expected returns, volatility, and maximum drawdowns would be established for each investment. In addition, the investor would set a target return, volatility, and maximum drawdown for the hedge fund portfolio as a whole. Due to the benefits of diversification, the hedge fund portfolio would likely have better expected risk/return performance than a simple average of the individual components would indicate.

Equity market-neutral and market-defensive funds of funds are two single-strategy hedge funds that resemble absolute return strategies because of their low standard deviations, low drawdowns, low correlation to equities, and low skewness and kurtosis similar to the normal distribution.

Professor's Note: Most mutual fund managers are evaluated by comparing their performance to a benchmark (i.e., relative return). Rather than trying to outperform a benchmark, hedge fund managers simply try to maximize returns. Their performance is thus measured in absolute terms rather than relative (to a benchmark) terms.

Diversified Fund Strategies

Diversified fund strategies tend to offer high returns, reasonable risks, and low drawdowns. Investors gain diversification benefits through global macro funds, systematic diversified funds (i.e., managed future funds), multistrategy funds, and FOFs. For example, a FOF program creates a portfolio of individual hedge funds in an effort to diversify away the idiosyncratic risk from any one manager. Global macro and systematic diversified funds historically exhibit positive skewness with a bias towards larger positive returns as opposed to negative returns. They also have Sharpe ratios significantly greater than that of the equity market and low kurtosis. During 2008, managed futures funds managed to earn positive returns and macro fund returns were near 0% while most other investment categories experienced large losses.

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Hedge Funds as Part of an Investment Program

LO 16.5: Demonstrate knowledge of hedge fund investment programs.

For example:

- **Identify and explain the parameters that may be used in a hedge fund investment program.**
- **Discuss three caveats that relate to the documented hedge fund investment performance and diversification benefits.**
- **Describe the characteristics and potential benefits of opportunistic hedge fund investing.**

Hedge Fund Parameters

Absolute return and volatility parameters should be identified both for an investor's overall **hedge fund program** (i.e., the process used to determine an investor's hedge fund portfolio) and for individual hedge fund managers. Factors to consider for setting program parameters are volatility, expected return, types of instruments traded, liquidity, leverage, and historical drawdown. Managers can also be evaluated by **assets under management** (AUM), length of track record, periodic liquidity, and required minimum investment level. Investors should set specific parameters that determine the construction and operation of the hedge fund program, risk and return targets, and allowable hedge fund strategies.

Hedge Funds within a Portfolio

When considering including hedge funds in an investment portfolio, an investor should look at the effects of hedge funds on a diversified portfolio. The ability of hedge funds to enhance returns and reduce risk should be considered. Hedge funds give an investor a different source of return and, in a portfolio context, may increase return for a given level of risk. Hedge funds have a lower standard deviation than many traditional asset classes. The low correlation of hedge funds with traditional financial assets offers the opportunity to reduce portfolio risk at a given portfolio return level. Increased Sharpe ratios of hedge funds suggest the investment opportunity set is expanded when hedge funds are added to a portfolio of traditional assets.

Investors considering hedge funds should be aware of the following three caveats:

1. Different hedge fund strategies may be affected by the same market shocks.

2. Past results are not an indicator of future results. In fact, for hedge funds, historical returns may overestimate future returns because the increasing amount of competition in the industry may result in greater market impact and trading costs.

3. Data on hedge fund performance are affected by survivorship and selection biases, which by some estimates can exaggerate annual returns by as much as 450 basis points. In addition, traditional mean-variance metrics such as Sharpe ratios may be inappropriate for analyzing hedge fund strategies with nonlinear payoff patterns and non-normal return distributions.

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Opportunistic Hedge Fund Investing

Hedge funds are an opportunistic investment in that they provide new opportunities that are not otherwise available through traditional long-only investments. The creation of new investment opportunities is also referred to as expanding the investment opportunity set. An investment strategy is **opportunistic** when the primary goal is to enhance returns through identification of superior investments.

Most opportunistic hedge funds are stand-alone strategies with their own benchmarks. Typically, opportunistic programs are used to complement a larger investment portfolio by enhancing the risk and return profile of the overall allocation. The implementation of such a program will vary depending on the constraints of the investment manager, but there are two key goals on which to focus: (1) adding value through specialization and (2) filling gaps in existing portfolios.

Opportunistic hedge funds add value to an existing portfolio through specialization. Hedge fund managers can narrow their focus to a particular market segment or sector in an effort to achieve superior returns in that area of the market. For example, a portfolio manager with expertise in oil companies may have better information to identify winning and losing companies in the energy sector. In a mutual fund format, the manager could use that information to purchase stocks that are likely to increase in value (e.g., long-only), but that would not maximize the value of the manager's information by taking short positions. In a hedge fund format, the manager could supplement long positions with short positions in energy stocks that are expected to decline in value in order to fully utilize her superior information. The opportunity created is the ability to add value on both the long and short side of the energy market.

In addition, the traditional long-only portfolios are benchmarked to passive indices. Managers are thus primarily concerned with tracking errors and may make trades to reduce tracking errors rather than to enhance returns. Opportunistic hedge funds are not constrained by tracking errors and, therefore, can focus on return enhancement.

Hedge Funds and Market Volatility

LO 16.6: Demonstrate knowledge of the market impact of hedge funds.

For example:

- **Discuss the evidence regarding the market impact of hedge funds during the Asian currency crisis of 1997.**
- **Discuss the evidence regarding the market impact of hedge funds during the crisis of 2007.**

Many institutional investors are afraid to be in any way publicly associated with fraud or impropriety. These investors are averse to headline risk. **Headline risk** causes some investors to omit hedge funds from their potential investment universe due to the perceived increased market volatility and increased market events attributed to hedge funds.

Academic studies are mixed regarding whether speculation causes market volatility or whether market volatility attracts speculation. There is little long-term evidence to suggest that markets are more volatile in the long run as a result of trading by speculators. Some

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empirical studies do not support the notion that hedge funds cause financial disasters, despite the blame such disasters receive.

Perhaps the most famous instance of blaming hedge funds for market calamities relates to George Soros' large bet in 1992 that the British pound sterling would devalue. When the pound did in fact devalue, Soros made over $1 billion in profits, which incited many critics to accuse Soros of causing the pound's decline. Analysis of Soros' bet found that he was not the primary cause of the devaluation, but his bet made the situation worse.

Brown, Goetzmann, and Park investigate the role of hedge funds in the Malaysian ringgit crisis in 1997. They conclude that there is no evidence that hedge fund manager currency exposures affected the ringgit. They also found no evidence that global hedge funds contributed to the dramatic decline of Asian currencies in the fall of 1997.

A study by Fung and Hsieh[2] in 2000 found that significant financial market events such as the October 1987 Stock Market Crash were caused by fundamental factors, not hedge funds. Hedge fund trading may increase the magnitude of a market event, but the funds do not cause the event. Regarding the extreme stock market returns in August 2007, Khandani and Lo[3] find that the returns are likely attributable to the liquidation of a major hedge fund strategy. They conclude that the simultaneous liquidation of a group of funds could severely damage the financial system. Despite this, Khandani and Lo argue that hedge funds have benefited economic development though their operations.

Hedge Fund Indices

LO 16.7: Demonstrate knowledge of hedge fund indices.

For example:

- **Describe hedge fund indices.**
- **Describe the challenges caused by management and incentive fees in constructing hedge fund indices.**
- **Recognize the challenges of including managed futures in hedge fund indices.**
- **Compare asset-weighted hedge fund indices and equally weighted hedge fund indices.**
- **Discuss the role of the size of the hedge fund universe in the construction of a hedge fund index.**
- **Recognize the concepts of representativeness and data biases (e.g., survivorship, selection, instant history, liquidation) and their effects on hedge fund returns reported by databases.**
- **Recognize the challenges involved in defining hedge fund strategies, and the effect of style drift.**
- **Identify issues that determine investability of hedge fund indices.**

It is relatively difficult to obtain information about hedge funds because they are private. Hedge funds are not required to provide information to a government regulator or to the public. As a result, it is difficult for many funds to gain visibility. One way that they can get the attention of the investing public is to release information to a database that specializes in

2 William Fung and David Hsieh, "Measuring the Market Impact of Hedge Funds," *Journal of Empirical Finance* 7 (2000).

3 Khandani, Amir E. and Andrew W. Lo, "What Happened to the Quants in August 2007?: Evidence from Factors and Transactions Data," October 24, 2008.

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hedge funds. For example, Hedge Fund Research, Inc. (HFR) collects information and sells it to advisors, institutional investors, consultants, and other investment professionals. Using this data, the providers create hedge fund indices, which can be used for benchmarking and performance evaluation as well as strategic asset allocation. In this section, we discuss some of the biases inherent in hedge fund databases as well as the advantages and difficulties of constructing indices using this data.

Effects of Fees on Hedge Fund Index Performance

The majority of hedge funds that report to databases have a management fee between 1% and 2% and an incentive fee of 20%. Typically, hedge fund performance is reported on a monthly basis, while incentive fees are calculated on an annual basis. Managers are required to estimate incentive fees when they report net returns. These estimates will often differ significantly from the actual fees, causing index returns to deviate from actual fund returns.

An additional issue regarding net returns to an investor is that, because hedge funds are private partnerships, each investor may have a different negotiated fee structure. The net return to one investor is likely not the same net return to another investor. Also, high-performing hedge funds will likely raise fees to new customers as time passes due to increased interest from investors. This bias is appropriately known as **fee bias.**

Managed Futures

While most index providers contain managed futures (i.e., commodity trading advisors), some indices do not. Due to the significantly different asset class and investment strategy used by managed futures, their exclusion or inclusion will significantly alter index performance.

Asset-Weighted vs. Equal-Weighted Indices

Asset-weighted indices give higher weight to large funds, causing the index to be more sensitive to reporting errors or large gains/losses from a large fund. Additionally, investors tend to follow large returns, so hedge funds that performed well recently will not only grow in index representation from higher returns but also from additional invested capital. Equal-weighted indices are not subject to these issues, because each hedge fund gets an equal representation in the index.

Because an equal-weighted index does not give preference to large funds or funds that attract large amounts of capital, most index providers prefer equal-weighted indices. However, asset-weighted indices have two advantages. First, an asset-weighted index incorporates transaction impacts resulting from fund size and, therefore, better reflects the performance of the hedge fund universe. Second, most indices for other financial products are asset-weighted. Therefore, an asset-weighted hedge fund index would be better for comparisons against traditional asset indices.

Indices and the Size of the Hedge Fund Universe

The true size of the hedge fund universe is unknown. This is a result of the high rate of attrition among hedge funds and the fact that they are typically not required to register with securities regulators. One effect of this unknown universe size is that hedge fund indices tend to have relatively little overlap, even among widely used indices that include more than

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1,000 funds each. Some investors subscribe to multiple index publishers and combine their data to get a broader view of the hedge fund universe than any single index provides.

Representativeness and Data Biases

An important characteristic of hedge fund databases is representativeness. **Representativeness** is the extent to which the characteristics of the sample are similar to the characteristics of the entire hedge fund universe. The sample may be biased if it favors the inclusion of observations based on unique characteristics. The effects of hedge fund database biases are discussed below.

Survivorship bias results when database vendors exclude from databases the historical performance of hedge funds that are dead or defunct (i.e., have closed and returned their investors' capital, been merged into other operations, or otherwise discontinued reporting to the database). Because the funds that are excluded are typically funds that have failed, the result of survivorship bias is to *overstate reported performance and understate risk.* Performance is overstated because funds with poor returns are excluded. Risk is understated because the poorly performing funds are excluded from the distribution of returns (i.e., the left tail of the distribution has artificially few observations).

Studies of survivorship bias in hedge fund databases have generated estimates that range from 2.6–5.0% (measured as the average surviving fund return minus the average overall database return). The differences in these estimates can be explained by the compositional differences in the databases chosen by the authors of the studies (i.e., a differing proportion of dead funds), inclusion of funds of funds (i.e., less susceptible to failure), and the starting date of the studies (i.e., most databases only started collecting data on dead funds after 1994).

While hedge fund databases are plagued by survivorship bias, it is typically not a problem for hedge fund indices. This is because similar to equity indices, the historical performance of hedge fund indices are not adjusted for defunct components. Instead, the defunct component is replaced by a new component in future iterations of the index.

Selection bias occurs when a hedge fund manager decides not to report (or to selectively report) results to a particular database. Because hedge funds are privately organized, they are only obligated to disclose performance and asset information to current investors. This means that a hedge fund manager decides which information he will include or exclude in reporting to a database or if he will report fund information at all. As a result, the observed sample may not provide an accurate representation of the industry's actual performance, and therefore, any index constructed on this observed data is potentially biased.

Instant history bias, also referred to as *backfill bias*, occurs when a database allows a fund to include its historical returns upon its initial inclusion into a database. Since reporting is voluntary, a manager will most likely not begin reporting until she has achieved a track record of positive results. This will result in an immediate positive bias in the database's historical performance when the fund's return history is added to the database. Estimates of backfill bias are between 1% and 5% annually. However, like survivorship bias, instant history bias is not significant for hedge fund indices because only the future performance of a newly added fund is added to an index.

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Liquidation bias occurs when a fund is going out of business and stops reporting returns prior to the fund's termination. During this liquidation period, the fund managers are busy wrapping up fund operations and will not have time to report returns to a database. The last few months of performance for a fund that is closing are likely not high. Therefore, the exclusion of these returns may create an upward bias in the index. **Participation bias** is the opposite of liquidation bias in that it occurs when fund managers stop reporting returns because they have achieved capacity for their strategy. In all probability, these funds have above-average returns and their removal from the index causes a downward bias in the index.

The hazard rate for hedge funds is the fraction of hedge funds that stop reporting to a hedge fund database at a given fund age. Research indicates that the highest hazard rate occurs for funds that are 14 months old. Many indices require a minimum fund history of two years for inclusion, which may result in a significant bias due to the exclusion of many younger funds.

While it is impossible to be certain of the cumulative impact of these biases, estimates indicate that biases could artificially inflate database performance by as much as 10% annually, while index performance is much less inflated.

Style Drift

Evidence indicates that even within a given style, different indices have widely different returns. This underscores the importance of hedge fund selection based on managers rather than styles. Because one unified system of hedge fund categories does not exist, each hedge fund index provider must create its own classification system and determine the strategy definitions. **Strategy definitions** refer to the method of grouping similar funds. This is problematic because there are different categories and category definitions for each provider. Therefore, what one index provider may classify as merger arbitrage may be classified in a different category by other index providers.

Style drift is an additional complication in classifying hedge funds by strategy. **Style drift** (or *strategy drift*) refers to the strategy or style drifting away over time from the original definitions. Because hedge funds are unregulated and tend to only report limited data, it may not be feasible for an index provider to determine if a hedge fund has drifted to a different strategy. A hedge fund might drift from a single strategy to a multistrategy or from a single strategy to another strategy (e.g., from long/short to a strict short-selling strategy).

Two trends in the industry are the evolution from single-strategy to multistrategy funds and the creation of synthetic hedge funds. **Synthetic hedge funds** attempt to earn hedge fund-like returns with lower fees using listed securities and quantitative models. These trends further increase the difficulty of proper fund classification.

Hedge Fund Investability

Hedge fund strategies (or alpha strategies in general) are subject to capacity limits. **Capacity** refers to the amount of investor capital a hedge fund manager can deploy and still implement the fund's investment strategy effectively. The ability for a hedge fund manager to successfully pursue a strategy erodes as the fund becomes too large. Therefore, many hedge funds have limits on fund size and will close the fund to new investors before the fund becomes too large.

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Investability refers to the ability of market participants to invest and achieve the returns of the index. Investable indices contain assets that are available to an individual investor. The investor could earn a return similar to the index by holding a portfolio containing the same funds in the same weights as the index. Hedge funds that are closed to new investors are no longer available and would not be part of an investable index. This creates a trade-off in indices between the representativeness of an index and an investor's ability to earn the returns of the index. Non-investable indices may be more representative of the total hedge fund universe, but a new hedge fund investor may not have access to higher earning funds that are already closed to new investors.

Additional issues regarding investable versus non-investable indices have to do with the reporting period of the indices. Major investable indices require daily reporting, while major non-investable indices only require monthly reporting. Daily reporting requires that the funds provide daily performance figures. Funds with illiquid assets may not be able to report on a daily basis. It may also be the case that fund managers may not be willing to compute and report figures on a daily basis. These issues likely contribute to the differences in the performance of investable and non-investable indices.

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Key Concepts

LO 16.1

The following are key elements characterizing hedge funds:

- Hedge funds are privately organized and generally unlisted.
- Hedge funds offer managers performance-based fees.
- Hedge funds invest in private securities, real assets, derivatives, and structured products and apply leverage, short sell securities, and take concentrated positions.

Relative to mutual funds, hedge funds can be managed with more flexibility in the following six ways:

1. Invest in private securities and real assets.

2. Use leverage, sometimes in high amounts.

3. Use derivatives, including long or short futures positions and buying or writing options.

4. Sell securities short.

5. Invest in structured products and other nontraditional securities.

6. Use complex active management strategies and dynamic risk exposures

The long-term growth trend for hedge funds is the result of their favorable investment attributes, which include:

- Low correlations with traditional investments, which provide diversification benefits to investors.
- The ability of hedge funds to hold both long and short positions.
- The potential for larger returns than traditional investments provide.

The 2007 financial crisis sparked a consolidation trend in the hedge fund industry as smaller participants exited the market and large firms became even larger.

LO 16.2

Total annual management fees are calculated as follows:

$$\text{annual fee} = \text{mgt fee\%(BNAV)} + \{\max[0,(\text{incentive fee \%}) \times (\text{GR} - \text{mgt fee} - \text{hurdle})]\}$$

High-water mark is the highest NAV that incentive fees were based on. A hurdle rate is a specific threshold (e.g., 4%) that the fund return must exceed prior to paying any incentive fees. Optimal contracting and managerial coinvesting are two techniques to reduce perverse incentives.

The annuity view of hedge fund fees demonstrates management's incentive to earn large returns over a long period of time. The option view of incentive fees suggests increasing the volatility of the fund will increase the present value of future management fees:

$$\text{incentive fee call option value} = i \times 40\% \times \text{NAV} \times \sigma_1$$

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Empirical studies find evidence suggesting managers take less risk to preserve their incentive fees when the incentive option is far in the money and refer to this behavior as the lock-in effect. They also find evidence of managing returns and massaging returns.

LO 16.3

The five major CAIA classifications of hedge fund strategies are:

- Macro and Managed Futures.
- Event-Driven.
- Relative Value.
- Equity.
- Funds of Funds.

Single-manager funds have underlying investments that do not consist of other hedge funds. Multistrategy funds are single-manager hedge funds with investments that include a variety of strategies. Funds of funds (FOFs) invest in a diversified group of single-manager funds and charge a second layer of fees to compensate the manager for portfolio construction, monitoring, and oversight.

LO 16.4

There are four broad categories of hedge fund strategies based on systematic risk exposure:

1. Equity strategies have some degree of systematic exposure. This strategy historically had the highest absolute value of correlation to equity markets.

2. Event-driven and relative value strategies take positions based on some event that has occurred or is likely to occur. Relative value strategies (or convergent strategies) take positions where the valuation between two securities is expected to normalize. Historical returns are similar to the insurance industry with small profits for the majority of time periods with occasional large losses.

3. Absolute return strategies attempt to earn positive returns regardless of the direction of the financial markets. Absolute return programs allow investors to achieve improved risk/return performance by capturing the benefits of fund diversification.

4. Diversified strategies (global macro funds, systematic diversified funds, multistrategy funds, and FOFs) diversify across different investment themes. A FOF program combines a portfolio of individual hedge funds in an effort to diversify away idiosyncratic risk.

LO 16.5

Hedge funds exhibit low correlation with traditional asset classes, suggesting significant diversification benefits. However, several caveats should be noted:

- Research suggests that shocks to one segment of the hedge fund industry are felt across various hedge fund strategies.
- Future results can deviate from historical performance.
- Survivorship and/or selection bias exists in empirical investigations. If these biases are not corrected, research indicates returns are inflated 70–450 basis points.

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Opportunistic hedge funds focus on adding value through specialization and filling gaps in existing portfolios. They are not constrained by tracking errors.

LO 16.6

Hedge funds did not cause financial market calamities during the Asian currency crisis of 1997.

Regarding the extreme stock market returns in August 2007, returns are likely attributable to the liquidation of a major hedge fund strategy. Despite this, researchers believe hedge funds have benefited economic development through their operations.

LO 16.7

Fee estimation errors and differences in fee levels among investors in the same hedge fund complicate the construction of hedge fund indices.

Due to the significantly different asset class and investment strategy used by managed futures, their inclusion or exclusion will significantly alter index performance.

Asset-weighted indices give higher weight to large funds than equal-weighted funds do, causing the index to be more sensitive to reporting errors or large gains/losses from a large fund. Equal-weighted indices are not subject to the issues that plague asset-weighted indices, because each hedge fund gets an equal representation in the index.

The true size of the hedge fund universe is unknown and hedge fund indices tend to have relatively little overlap, even among widely used indices that include more than 1,000 funds each.

Representativeness is the extent to which the characteristics of the sample are similar to the characteristics of the entire hedge fund universe. Biases that affect a sample's representativeness include:

- Survivorship bias results when database vendors exclude from databases the historical performance of hedge funds that are discontinued.
- Selection bias occurs when a hedge fund manager decides not to report (or to selectively report) results to a particular database.
- Instant history bias occurs when a database allows a fund to include its historical returns upon its initial inclusion into a database.
- Liquidation bias occurs when a fund is going out of business and stops reporting returns prior to the fund's termination.
- Participation bias occurs when a fund stops reporting to a database due to reaching capacity.
- Style drift refers to the strategy or style drifting away over time from the original definitions.
- Investability refers to the ability of market participants to invest and achieve the returns of the index.

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Concept Checkers

1. Which of the following is **NOT** a characteristic of hedge funds? Hedge funds:
   A. are privately organized and generally unlisted.
   B. offer managers high fixed fees.
   C. invest in private securities, real assets, derivatives, and structured products.
   D. use leverage, short positions, and concentrated positions.

2. What type of hedge fund seeks diversification benefits similar to a mutual fund?
   A. Activist.
   B. Distressed.
   C. Event-driven.
   D. Fund of funds.

3. Suppose XYZ hedge fund has a net asset value (NAV) of $300 million at the start of the year and $355 million at the end of the year before fees. Manager fees are paid annually based on a "2 and 20" arrangement. If management fees are distributed annually based on the start-of-the-year NAV, what are the total annual fees assuming no hurdle rate or high-water mark?
   A. $15.80 million.
   B. $16.68 million.
   C. $17.00 million.
   D. $76.00 million.

4. Which of the following statements concerning an opportunistic hedge fund investment program is **FALSE**?
   A. Most opportunistic hedge funds are stand-alone strategies.
   B. Opportunistic hedge funds tend to be absolute return investment vehicles.
   C. Opportunistic strategies are most often used to complement a larger investment portfolio.
   D. Most opportunistic hedge fund strategies have a benchmark.

5. Which of the following conclusions regarding financial market events and hedge funds is **FALSE**?
   A. The Asian currency crisis was not caused by hedge fund activity.
   B. The Malaysian ringgit crisis was not caused or magnified by hedge fund activity.
   C. The impact of the 1992 devaluation of the British pound sterling was likely exacerbated by hedge fund activity.
   D. The returns of the stock market in August 2007 were not caused by hedge fund activity.

6. One concern regarding the representativeness of a hedge fund database occurs when a database allows a fund to include its historical returns upon its initial inclusion into a database. This is known as:
   A. backfill bias.
   B. liquidation bias.
   C. selection bias.
   D. survivorship bias.

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Concept Checker Answers

1. **B** Hedge funds attract the top managers because they offer *performance-based* fees, which vary based on fund performance. (LO 16.1)

2. **D** A fund of funds consists of investments in other hedge funds and is, therefore, more diversified than other hedge fund types. (LO 16.3)

3. **A** Annual management fee = 2% × $300 million = $6 million

   The incentive fee is calculated by multiplying the incentive percentage fee of 20% by the profit, less the annual management fees as follows:

   incentive fee = 20% × ($355 – $300 – $6) = $9.8 million

   total annual fees = management fee + incentive fee = $6 million + $9.8 million = $15.8 million

   (LO 16.2)

4. **B** Opportunistic hedge funds are typically not absolute return vehicles. Most opportunistic strategies either use a long/short strategy to maximize a manager's information in a particular sector or combine otherwise separate asset classes to expand the investment opportunity set. In either case, performance is usually measured relative to a benchmark rather than on an absolute return basis. (LO 16.5)

5. **D** Regarding the extreme stock market returns in August 2007, returns are likely attributable to the liquidation of a major hedge fund strategy. The other choices are correct. (LO 16.6)

6. **A** Instant history or backfill bias occurs when a database allows a fund to include its historical returns upon its initial inclusion into a database. (LO 16.7)

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The following is a review of the Hedge Funds principles designed to address the learning objectives set forth by the CAIA Association®.

Macro and Managed Futures Funds

Topic 4.2

Exam Focus

We discuss the attributes of global macro and managed futures funds in this topic review. Candidates should know the difference between discretionary and systematic fund managers and the difference between fundamental and technical analysis. Be able to identify, apply, and validate systematic trading rules. Understand trend-following, non-trend-following, and relative value strategies. Finally, be familiar with the characteristics of the return distributions of global macro and managed futures funds and the associated risks of each investment type.

Professor's Note: In order to improve the readability of this topic review, we have rearranged the order of the LOs. However, every LO is still covered in detail.

Global Macro Funds

LO 17.2: Demonstrate knowledge of global macro funds.

For example:

- **Describe the key characteristics of global macro funds.**
- **Be familiar with examples that illustrate the foundation of global macro trading strategies.**
- **Recognize the main risks (i.e., market, event, and leverage) of macro investing.**

Global macro funds (also referred to as simply *macro funds*) are opportunistic in nature, use a top-down (i.e., macro) approach to analyzing global macroeconomic events, and can invest anywhere in the world based on forecasts of economic growth, currency movements, and changes in interest rates. In addition, global macro managers utilize a variety of security types, use leverage to enhance returns, and typically do not have short selling constraints. The strategy's lack of constraints provides managers the ability to adapt their strategy to optimize returns under current market conditions. However, global macro funds are well suited to a high-volatility market due to the increased number of available trading opportunities.

Since 2000, institutional investors have increasingly forced global macro managers to pursue more well-defined, focused, and liquid strategies than those used in the past. This increased specialization has led to lower volatility and lower returns. In addition, the specialization has caused institutional investors to diversify among global macro funds in an attempt to improve the risk/return performance of their allocation to this sector.

As you read this topic review, keep in mind that the large variety of strategy implementations utilized by global macro funds leads to a return dispersion that is quite

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scattered. That is, correlations between the aggregate returns of the global macro sector and that of a particular global macro fund may be relatively low. As a result, manager selection is a primary determinant of investor returns.

Characteristics of Global Macro Funds

Global macro strategies are most profitable when market events cause increased uncertainty and/or volatility. Higher levels of volatility cause the market to become more directional in nature, providing global macro managers with profitable investment opportunities. Success in global macro investing relies on manager skill in understanding and anticipating global and domestic markets. Strategies involve exchange rates, interest rates, inflation rates, country economic growth rates, regional growth rates, other macroeconomic factors, and thematic investing. **Thematic investing** strategies are based on secular (e.g., population trends) or fundamental economic variables or relationships rather than on specific markets or securities. Examples of inefficiencies pursued by global macro funds include:

- Differences in the policies pursued by nations' central banks.
- Tax and regulation discrepancies between regions.
- Divergent opinions about future market performance.
- Business cycle discrepancies between countries.
- Behavioral biases exhibited by market participants (e.g., undervaluing new market information).
- Monetary policy mistakes (e.g., failure to prevent hyperinflation).
- Macro country events (e.g., political instability, unanticipated central bank activities, increased sovereign debt risk).

The strategies used by global macro are in sharp contrast to funds that utilize market microstructure. **Market microstructure** refers to the structure and processes of a market that may affect the pricing of securities in relation to intrinsic value and the ability of managers to execute trades.

Risks of Macro Investing

Macro funds have global risk exposures that differ from other hedge fund strategies. The three primary risks of global macro funds include market risk, event risk, and leverage risk.

1. **Market risk** is concerned with exposure to unexpected changes in global and/or domestic market direction. Macro funds often are exposed to concentrated risks in currency, commodity, and sovereign debt markets. They anticipate changes in government policies and the implications for related markets. If reality diverges substantially from their forecasts, macro funds can face large losses.

2. **Event risk** is exposure to unexpected changes in market conditions related to a specific event. A good example is the bankruptcy of Lehman Brothers during the 2007–2008 financial crisis. Macro funds can have substantial changes in value in short time periods.

3. **Leverage risk** refers to magnifying the risk of concentrated positions using futures, swaps, and forward markets. Macro funds with significant leverage may require additional capital if their positions incur losses. Highly leveraged positions may make it impossible to provide adequate capital, and the funds will be forced to liquidate positions at the worst time, yielding significant losses.

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Historical Performance of Macro Investments

LO 17.3: Demonstrate knowledge of the historical performance of macro investing.

For example:

- **Recognize inferences that can be drawn from comparing definable characteristics of macro investing with its historical stand-alone and portfolio performance.**

Using the Hedge Fund Research, Inc. (HFR) Macro Index and the Credit Suisse Global Macro Index as proxies for the performance of global macro, we can examine how the strategy performed from 2000–2014. Both global macro indices had excellent risk-adjusted performance with high mean returns and low volatility. The Sharpe ratios for both were higher than Sharpe ratios of global equities, global bonds, U.S. high-yield bonds, and commodities. During this period, macro strategies had low to modest correlations with world equities, global bonds, and commodities and slight negative correlations with credit spreads and equity volatility. The worst two return months for macro strategies correspond to the worst months for world equities. However, large positive monthly returns for the macro strategies also corresponded to months with negative equity returns. As a result, the addition of a global macro fund allocation to a traditional stock and bond portfolio would likely result in lower overall risk, higher returns, and improved diversification.

Managed Futures: Characteristics and Industry Overview

LO 17.4: Demonstrate knowledge of managed futures.

For example:

- **Describe the key characteristics of managed futures funds.**
- **Discuss regulation, background, and organizational structures (i.e., public commodity pools, private commodity pools, and individually managed accounts) of the managed futures industry.**

Managed futures strategies involve actively trading futures and forward contracts on physical commodities, financial assets, and exchange rates. The history of managed futures began with commodity futures in 1848, prior to the development of financial futures. Financial futures were developed in the 1970s and became popular in the 1980s as managers of futures accounts developed more sophisticated strategies of hedging financial risk.

Characteristics of Managed Futures Funds

The managed futures industry allows investors the risk and return investment opportunities of actively managed future contracts. The overall investor objectives in managed funds are typically to enhance returns and to achieve diversification. Managed futures strategies are typically based on technical analysis and systematic trading rather than fundamental analysis and discretionary trading.

Investors who desire to speculate in commodities, such as corn or gold, for short time horizons typically do so with futures or forward contracts. This avoids costly storage,

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delivery, and finance costs of holding real assets. In addition, the futures and forward contracts have lower transaction costs, higher liquidity, and more flexibility in short selling.

Regulation and Structure of Managed Futures

The **Commodity Exchange Act** (CEA) was passed in 1936 to regulate the commodities market. The CEA was amended in 1974 to create the **Commodity Futures Trading Commission** (CFTC) in order to enforce the original Act. The CEA set standards for three key areas: financial reporting, recordkeeping, and offering memorandum disclosure.

Congress defined the terms and roles of **commodity pool operators** and commodity trading advisors under the framework of CEA. Commodity pool operators (CPOs) are the general partners in a commodity pool. A **commodity pool** collects funds from a group of investors and then invests these funds in commodity futures markets. Commodity pools are a subset of the hedge fund market. Commodity pools are managed by a general partner, who generally must register as a CPO with the CFTC and the NFA.

Both public and private CPOs typically hire professional money managers called **commodity trading advisors** (CTAs) to manage the funds in the commodity pool. However, in some cases the CPO and the CTA are the same entity. Congress requires CPOs and CTAs to obtain periodic training in cooperation with the **National Futures Association** (NFA). The NFA became the designated self-regulatory organization for the managed futures industry.

The managed futures industry comprises three segments: (1) public commodity pools, (2) private commodity pools, and (3) individual accounts. Investors seeking to gain exposure to skill-based commodity investments will utilize one of these structures.

Public commodity pools are available to the general public and are required to register with the Security Exchange Commission (SEC) and file reports with the CFTC. Public commodity pools have low initial minimum levels of investment and are considered liquid investments (i.e., easy to convert to cash at market value).

Private commodity pools avoid SEC registration requirements by selling to institutional investors and high net worth individuals. Depending on the account's characteristics, they may also avoid the reporting requirements of the CFTC. Compared to public commodity pools, private commodity pools have lower brokerage commissions and more flexibility in implementing investment strategies.

Managed accounts (also known as *individually managed accounts* or *separately managed accounts*) are reserved for wealthy individuals and institutional investors whose portfolios are large enough to warrant a separate account with a specific investment mandate. The investor gives the manager complete trading authority on the account. Public and private commodity pools combine the funds of multiple investors to invest in commodities futures. Managed accounts have the advantage of tailoring investment objectives to specifically meet the needs of the investor. Another important advantage of managed accounts is related to control and **transparency**, which enables investors to see all trading activity and give investors more control over the amount of leverage used. CPOs and CTAs charge both management and performance fees similar to hedge funds. The standard fees charged by CPOs and CTAs are a 2% management fee and a 20% incentive fee, or simply "2 and 20." However, management fees can range from 0–3%, and incentive fees can range from 10–35%.

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Differences Between Macro and Managed Futures Funds

LO 17.1: Demonstrate knowledge of major distinctions within the category of macro and managed futures funds.

For example:
- **Distinguish between discretionary fund trading and systematic fund trading.**
- **Define technical analysis and fundamental analysis, and discuss the reasons for pursuing each.**

Macro and managed funds share several characteristics. Both strategies generally have more liquidity and capacity than other hedge fund strategies. **Capacity** is the amount of capital a fund can deploy without significantly reducing its risk-adjusted performance. Macro and managed funds also typically have less **counterparty risk**, which is the uncertainty related to a third-party's ability to fulfill its obligations due to insolvency or illiquidity. In this section, we will examine the strategies' trading styles (discretionary versus systematic) and their inputs (technical versus fundamental).

Discretionary vs. Systematic Fund Trading

Discretionary fund traders are typically fundamental researchers. They analyze publications from central banks, key confidence indicators, statistics on asset flows, measures of liquidity, and even comments made by politicians. Developing a network of personal contacts who are "in the know" to obtain information is an important component of this approach. The discretionary manager's goal is to understand underlying macroeconomic and asset class trends, develop likely (and unlikely) market scenarios based on these trends, and ultimately identify the best risk/reward opportunities. From there, discretionary managers often use technical analysis to identify entry and exit points for individual securities. The result is a discretionary portfolio that depends greatly on the skills and subjective assessments of the individual manager. Discretionary managers use many trading strategies (sometimes borrowing from other hedge fund styles) and switch between them as needed. Discretionary managers may also employ quantitative models. Unlike systematic managers, discretionary managers may choose to override the model or employ a variety of models.

Systematic fund traders follow a standardized, structured investment process that is objective in nature. Systematic managers rely on a consistent system of looking at economic data and using **black-box trading models** to assess markets, identify opportunities and market signals, and establish entry/exit points for individual securities. Like discretionary managers, systematic managers use technical analysis. However, systematic managers tend to use technical analysis to follow directional trends in markets and use tools, such as moving averages, chart patterns, and breakout systems, to capitalize on these trends. Some systematic managers are referred to as *global trend followers* as their process leads them to longer-term macroeconomic trends.

Discretionary trading strategies are preferred by most macro funds, while systematic trading strategies tend to be utilized by managed futures funds.

Technical Analysis vs. Fundamental Analysis

Technical analysis is based on the assumption that investor behavior (both rational and irrational) is reflected in trends and patterns that tend to repeat and can be identified and

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used for forecasting prices. It uses inputs, such as price, volume, and volatility, to forecast future prices. Technical managers use these forecasts to create a set of trading rules based on predictable price patterns. Buy and sell signals alert the investor to trade once the futures prices reaches a pre-determined reference point. Long futures positions are taken when signals indicate that the futures prices are beginning an upward trend, and short futures positions are taken when signals indicate that futures prices are beginning a downward trend.

Fundamental analysis refers to a set of methods designed to identify departures of prices from their fair values. Divergences are identified based on fundamental economic indicators (e.g., interest rates, economic growth, currencies, and industry factors). The economic indicators may be either market-level information or a set of company-specific information used to form market-level expectations. Long futures positions are taken when the futures price is below its fair value, and short futures positions are taken when the futures price is above its fair value.

Professor's Note: Managers form their capital market expectations using fundamental analysis, technical analysis, or a combination of the two.

Systematic Trading

LO 17.5: Demonstrate knowledge of systematic trading.

For example:
- **Identify methods for and issues involved in deriving systematic trading rules.**
- **Recognize key questions to ask when evaluating individual trading strategies.**
- **Describe key components of methods used to validate systematic trading rules and the detection and effects of trading rule degradation.**

Systematic trading refers to black-box, quantitative, and computer-based trading and often employs technical analysis to apply a fixed set of trading rules for entering and exiting the market.

Systematic Trading Rules

Historical price patterns are identified by analyzing historical futures price data. This quantitative analysis is referred to as **backtesting**. Models that perform well using historical data in backtests often do not perform as well when implemented for actual portfolios. Transaction costs and slippage should also be included in backtests. **Slippage** is the difference between expected entry and exit prices based on the model and actual entry and exit prices. Slippage occurs naturally in practice because buy orders tend to increase prices and sell orders tend to decrease prices. In order to successfully implement systematic trading models, it is necessary to distinguish between spurious results and persistent results. It is also important to identify when to abandon or modify the trading system.

Evaluating Trading Strategies

Systematic strategies often use multiple trading systems rather than an individual trading system. Investors must modify the systems over time to compensate for evolving market

changes. The following three questions address important issues related to individual trading systems:

1. How was the trading system developed and what is it? It is important to understand the research methods used to develop the system to determine if there is over-fitting of historical data.

2. Why does the trading system work and when will it not work? It is important to examine the impact of market conditions on the system.

3. How can an investor implement the trading system? Operational factors related to data sources, trades, and recordkeeping must be addressed.

Validation and Trading Rule Degradation

Validation refers to the process of using new data or methodologies to test a trading rule developed with a different data set or different model. **Robustness** refers to how well the model works over different time periods, datasets, or applications.

The inputs that are used to develop a model are known as its **in-sample data**. It is important to validate a model with **out-of-sample data** for a more recent time period than its in-sample data. Furthermore, it is also very important to quantify the number of trading rules tested, validated, and rejected. For example, assume 20 different parameters are tested for one model. On average, one of 20 will survive the validation process at a 95% confidence level even if the trading rule is not valid.

Trading rules and markets evolve over time. A profitable trading strategy is often detected and implemented by other CTAs. **Degradation** refers to trading rules becoming less effective over time. A trading rule that was successful over the past 10 years is unlikely to persist in effectiveness over the next 10 years. It is important to distinguish between evolving trading rules that are effectively identifying evolving price patterns and trading rules that are data dredging for a pattern that ceases to exist. Therefore, careful statistical analysis is required to validate and test trading patterns for degradation.

Systematic Trading Strategies

LO 17.6: Demonstrate knowledge of systematic trading strategies.

For example:
- **Describe the characteristics of trend-following strategies.**
- **Define and apply simple moving averages, weighted moving averages, and exponential moving averages.**
- **Define and apply breakout trading rules.**
- **List the conclusions of research on the nature and efficacy of trend-following strategies.**
- **Identify non-trend-following strategies and their trading signals.**
- **Describe the characteristics of relative value strategies.**

Three categories of systematic trading strategies are (1) trend-following, (2) non-trend-following, and (3) relative value.

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Trend-Following Strategies

Trend-following strategies refer to trading strategies that attempt to exploit predictable price patterns after the trend has begun (i.e., wait for the trend to emerge, then follow it). Examples include moving average and breakout strategies. **Momentum** is the degree to which security price movements are followed by subsequent movements of the same security.

Investors try to establish long positions in securities with upward momentum and short positions in securities with downward momentum. For example, consider the corn futures market. Long positions in corn futures are taken once the futures price rises above its moving average price or once a shorter-term moving average rises above a longer-term moving average (e.g., a 10-day vs. 20-day moving average system). Conversely, short futures positions are taken once the corn futures price falls below its moving average or once a shorter-term moving average falls below a longer-term moving average.

The exact opposite of momentum price movement is mean-reverting price movement. **Mean-reverting** suggests the security has a tendency to return to its previous price level after a move in one direction. If price movements are independent from current or past prices, then the prices exhibit a **random walk**. If security prices follow a random walk, then they do not exhibit properties of momentum or mean reversion.

Moving Averages

It is common practice for trend-following analysts to use simple moving averages, weighted moving averages, and/or exponential moving averages to identify trends and price patterns.

The **simple moving average** (SMA) is the *arithmetic average* (i.e., *equally weighted average*) of the closing prices:

$$SMA_t = \frac{\sum_{t=1}^{n} P_{t-1}}{n}$$

where:
P_{t-1} = closing price on day $t-1$
n = number of days used

Example: Calculating a simple moving average (SMA)

Given the following price data, **calculate** a 3-day SMA on Saturday.

Day	*Price*
Monday	500
Tuesday	510
Wednesday	511
Thursday	508
Friday	510

Answer:

$$SMA_{Saturday} = \frac{(511+508+510)}{3} = 509.67$$

Under an SMA, all prices are equally weighted. The weighted or exponential moving averages assign more weight to more recent observations. A **weighted moving average** (WMA) is an arithmetically declining average of more distant prices. The following equation illustrates that the oldest price is multiplied by 1, the second oldest is multiplied by 2, and this continues until the most recent price is multiplied by *n* (total number of observations or days in the moving average).

$$WMA_t(n) = \frac{n}{N}P_{t-1} + \frac{n-1}{N}P_{t-2} + \ldots + \frac{1}{N}P_{t-n}$$

where:
N = 1 + 2 + 3 + ... + n

Example: Calculating a 3-day weighted moving average (WMA)

Given the following price data, **calculate** a 3-day WMA on Saturday.

Day	*Price*
Monday	500
Tuesday	510
Wednesday	511
Thursday	508
Friday	510

Answer:

$$WMA_{Saturday}(3) = \frac{3}{6}\times 510 + \frac{2}{6}\times 508 + \frac{1}{6}\times 511 = 255 + 169.33 + 85.17 = 509.5$$

The **exponential moving average** (EMA) uses a *smoothing factor*, λ, to determine the influence of recent prices relative to prior moving averages. The larger the smoothing factor,

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the more closely the EMA will track to the current price. The EMA is a function of the smoothing factor, λ, the most recently observed asset price, and the calculated EMA for the prior period. The EMA is expressed algebraically in the expanded form as:

$$EMA_t(\lambda) = \lambda P_{t-1} + \lambda (1-\lambda)P_{t-2} + \lambda (1-\lambda)^2 P_{t-3} + \lambda (1-\lambda)^3 P_{t-4} + \ldots$$

EMA is expressed in the reduced form as:

$$EMA_t(\lambda) = (\lambda \times P_{t-1}) + [(1-\lambda) \times EMA_{t-1}(\lambda)]$$

Professor's Note: Notice that the first terms of both EMA equations are equivalent, λP_{t-1}. The second term of the latter equation is simply weighting the previous day's EMA.

Example: Calculating an exponential moving average (EMA)

Given the following price data, **calculate** the EMA for day *t* and day *t*+1.

$\lambda = 0.06$

$EMA_{t-1} = 512$

closing $\text{price}_{t-1} = 540$

closing $\text{price}_t = 538$

Answer:

$EMA_t = 0.06(540) + 0.94(512) = 32.4 + 481.28 = 513.68$

$EMA_{t+1} = 0.06(538) + 0.94(513.68) = 32.28 + 482.86 = 515.14$

Professor's Note: Notice a higher λ gives more weight to the most recent prices.

Common moving average trading strategies for futures include the following:

- A buy (sell) signal is generated when the price is above (below) a moving average or group of moving averages.
- A buy (sell) signal is generated when a shorter-term moving average crosses above (below) a longer-term moving average.
- A buy (sell) signal is generated when a group of moving averages all increase (decrease).

Traders often use two moving averages to determine buy and sell points. For example, if a 10-day moving average crosses below a 45-day moving average, it is considered a sell point. When the 10-day moving average crosses above a 45-day moving average, it is considered

a buy signal. Trend-following strategies perform best in markets with an extended move in price with low daily volatility. A market experiencing high daily volatility but without a persistent direction is called a **sideways market** and can lead to whipsawing. **Whipsawing** occurs when a trader establishes a long position immediately prior to a price decline or a short position immediately prior to price increase.

Breakout Strategy

In a **breakout strategy** (also known as a *channel breakout strategy*), a long futures position is taken once the futures price breaks through its high during a specified look-back period. The look-back period refers to the number of trading days over which the channel is constructed. For example, in a 20-day look-back, today's futures price is compared to the trading range of futures prices over the past 20 trading days. Channels are constructed around the future's trading range, and long futures positions are taken once the futures price breaks through the upper bound of the channel. Conversely, short futures positions are taken once the futures price falls through the lower bound of the channel.

Common breakout strategies can be summarized as follows:

- Create a channel of prices with an upper and lower bound defined as:
  - Upper bound equals the highest high price over the last n days (most commonly 20 days).
  - Lower bound equals the lowest low price over the last n days.
- A buy signal is generated when the price is above the upper bound.
- A sell signal is generated when the price is below the lower bound.

Example: Breakout strategy

Suppose the analyst uses a look-back of ten days. The closing prices for days –10 to –1 are: 101, 100, 99, 96, 99, 104, 101, 103, 105, and 102.

- **Determine** what position, if any, an analyst should take if the day 0 price is 106.
- **Determine** what position, if any, an analyst should take if the day 0 price is 95.

Answer:

The analyst should establish a long position when the price reached 106, as this is the highest price over the look-back period.

The analyst should establish a short position when the price reached 95, as this is the lowest price over the look-back period.

Research Regarding Trend-Following Strategies

The dominant strategy of managed futures is a trend-following strategy based on moving averages. Studies describe two major drawbacks to using moving averages for trend-following strategies. First, signals occur too late and managers are slow to recognize the start or end of trends. Second, moving average trends are based on momentum or patterns that should not persist in competitive markets.

Some researchers define trend-following strategies as long volatility strategies. They hypothesize that trend-following strategies produce alpha when market prices exhibit large

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unidirectional changes that generate higher reported volatility. For example, consistent positive daily or weekly returns may compound over time to result in large positive monthly returns, but the daily or weekly standard deviation may be low, as it does not deviate far from the mean. Thus, depending on how volatility is defined or examined (daily, weekly, or monthly), trend-following strategies may or may not be accurately described as being long volatility.

One study examined the volatility exposure of managed future strategies implemented by CTAs that take long gamma positions. **Gamma** is the risk exposure from increasing long positions in rising markets and decreasing short positions in falling markets. Findings suggest managed futures strategies benefit when markets trade in wide ranges with prolonged moves between levels. Conversely, trend-following strategies do poorly when markets trade in narrow ranges and exhibit negative autocorrelation. The challenge for CTAs seeking alpha is identifying when markets will trend and when markets will not trend.

Non-Trend-Following Strategies

Non-trend-following strategies attempt to take advantage of perceived inconsistencies in futures prices. One group of non-trend-following strategies consists of **pattern recognition systems**, which look for market anomalies in market price patterns or volatility patterns. The second group of non-trend following strategies are **countertrend strategies**, which are designed to profit by trading against the current trend. Long futures positions are taken when the market is deemed oversold and short futures positions are taken when the market is deemed overbought. Often the **Relative Strength Index** (RSI) is used to determine the extent to which the market is overbought or oversold. The RSI is calculated as follows:

$$\text{RSI} = 100 - \frac{100}{1 + \frac{\text{U}}{\text{D}}}$$

where:
U = average of price changes for all up days for the last *n* days
D = average of the absolute value of price changes for all down days for the last *n* days

The RSI strategy can be summarized as follows:

- Calculate the average of all up days (i.e., price changes on days where the price increased) over the last *n* days (most commonly 14 days).
- Calculate the average of all down days (i.e., price changes on days where the price decreased) over the last *n* days.
- Calculate the RSI.
- A buy signal is generated when the RSI < 30.
- A sell signal is generated when the RSI > 70.

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Example: Calculating the relative strength index

The mean of price increases for White Fox, Inc., over the last 30 days was $0.05. The mean of prices decreases was $0.25. **Calculate** the RSI and **decide** if the security has been oversold or overbought. Also, **decide** if you should buy or sell White Fox stock.

Answer:

$$\text{RSI} = 100 - \frac{100}{1 + \frac{0.05}{0.25}} = 16.67$$

RSI < 30, the stock is oversold, and you should buy White Fox.

Countertrend strategies rely on frequent trading (more so than trend-following strategies). Also, countertrend strategies do best in markets with high volatility within a stable trading range. High volatility is needed in order to determine if a market is overbought or oversold. When markets spike downward, the contrarian will take a long position expecting to profit when the market reverses. When markets spike upward, the contrarian will take a short position expecting to profit when the market reverses. Spikes and reversals are key requirements for the success of countertrend strategies.

Relative Value Strategies

Relative value strategies attempt to exploit price inefficiencies between two related (correlated) futures contracts or between different maturities on the same contract. Relative value arbitrage involves the simultaneous purchase and sale of two highly correlated contracts that are deemed to differ from their fair values. For example, the CTA might believe that oil is overbought relative to gasoline (i.e., the price spread is abnormal). In this case, a short position is taken in oil futures, and a long position is taken in gas futures. The positions are unwound once the spread converges to its normal value. RSIs can be used in relative value strategies. Generally, a series of price differences is calculated and then the RSI is calculated on the price differences.

Professor's Note: Traders are concerned about the ability of strategies to succeed consistently over time. Competition in the marketplace will affect the strategy's degradation or speed with which the strategy ceases to generate attractive profits.

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Empirical Studies Regarding Managed Futures

LO 17.7: Demonstrate knowledge of empirical research on managed futures.

For example:
- **Discuss empirical evidence regarding managed futures returns and the downside risk protection offered by managed futures.**
- **Describe the reasons why managed futures might provide superior returns.**
- **Describe the risks of managed futures funds.**

The empirical studies of managed futures covered in this section examine the actual returns of managed futures funds or test simulations of well-known managed futures trading strategies. These studies can help determine if managed futures are worthwhile additions to a portfolio and assess the primary sources of risk and return for the strategy.

Alpha Generation

Using actual returns, Kazemi and Li (2009)[1] find that CTAs are able to time the market achieving long positions in rising markets and short positions in falling markets. This indicates that CTAs have market timing ability. Miffre and Rallis (2007)[2] examine 31 commodity futures contracts for price momentum. Their simulated results suggest 13 strategies were profitable for the January 31, 1979 to September 30, 2004 period. In general, findings of studies support the use of managed futures in a diversified portfolio. However, if a CPO is used, many of the benefits are reduced or eliminated due to the second level of fees that are charged by CPOs.

Downside Risk Protection

An analysis of the historical returns of managed future funds indicates that they performed relatively well following the 2007 financial crisis. **Conditional correlation coefficients** are used to determine correlations when a factor meets a specified condition. Managed futures had a low or negative conditional correlation to equities in down equity markets and positive conditional correlation to equities in rising equity markets. This suggests managed futures possess excellent downside risk protection and diversification benefits for an investment portfolio.

Managed futures and macro funds had returns that are distributed close to normally with skewness near zero. Managed futures typically have higher standard deviations than most hedge funds but smaller maximum drawdown than equity markets. One study found that a portfolio composed of 50% CTA managed funds and 50% S&P 500 stocks outperformed a portfolio composed of the S&P 500 index and protective put options.

To evaluate the skill of a CTA, an investable, passive benchmark that uses a trend-following strategy can be employed. In this strategy, if the price of an asset is trending upward (has upward momentum), the trend-following investor buys the asset. If the asset is trending downward, the investor sells the asset.

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1 Kazemi, Hossein B. and Ying Li, "Market Timing of CTAs: An Examination of Systematic CTAs vs. Discretionary CTAs," Journal of Futures Markets 29, no. 11 (2009): 1067–1099.

2 Miffre, J. and G. Rallis, "Momentum Strategies in Commodity Futures Markets," *Journal of Banking & Finance* 31, (2007), 1863–1886.

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The **Mount Lucas Management Index** (MLMI) is an example of such an index. The MLMI is a passive futures index that allows for both long and short futures positions in physical commodities, financial securities, and currencies. A 12-month moving average determines if the index is long or short in each of the futures contracts included in the index. If the unit value for a component futures contract is above (below) the 12-month average, the MLMI buys (shorts) the futures contract. The distribution of returns for the MLMI is slightly positively skewed but almost normal.

A highly skilled CTA will have a distribution of returns that is positively skewed. Since the skewness of the benchmark, MLMI, is only slightly positive, a CTA with positive skewness indicates the CTA was able to add value for investors.

Potential for Outsized Returns

Future contracts are zero-sum games with narrow bid-ask spreads. Thus, any gain on one side of the trade is offset by an equal loss on the other side of the trade. There is no illiquidity premium and there is little reason to believe an investor on one side of the trade has an information advantage. So how can there be a logical explanation for generating alpha in the futures market?

A conceptual framework to explain why managed futures provide superior returns is related to their role in hedging. A **natural hedger** seeks to hedge a risk that is the result of its fundamental business activities. For example, farmers who produce corn may take a short position in corn futures to hedge their future income. In effect, the farmers are locking in their selling price at harvest time. Cattle farmers are an example of a natural hedger on the buy side who hedge the future cost of a production input (i.e., corn).

With an equal amount of natural hedgers on both sides of the trade, a CTA can only profit at the expense of another CTA. However, if there are no natural hedgers on one side of the futures trade, then CTAs can play a valuable role as speculators and earn positive excess returns for providing this service to natural hedgers. In addition, if natural hedgers have different time horizons, risk profiles, and break-even points, this could explain future prices and excess returns required by speculators who are willing to provide this service. In other words, a corn farmer whose entire future income is based on future corn prices may be willing to lock in a futures price slightly less than the expected market price due to his low risk tolerance level regarding potential losses.

Another example is related to central banks that may temporarily manipulate exchange rates according to policy agendas. CTAs may take opposite positions seeking profits at the expense of the central bank.

Risks of Managed Futures

Hedge fund managers using quantitative programs are very protective of their black-box trading programs. This results in **transparency risk** for investors who are not well-informed of the methods used and the range of potential outcomes. These algorithmic models rely on trade signals, which may lead to **model risk**, which is the possibility that a model will not produce its intended returns. Model risk is present if the programs are not adequately back-tested for various market conditions that may arise.

If there is not enough depth in a market, then a managed futures fund has **capacity risk**. The fund cannot grow if there are not enough futures traded in that market. **Liquidity risk**

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is related to capacity risk in that a large fund influences the price of a thinly traded futures market. When there is too much competition trading for the same futures contracts, the price of the contract will be affected.

Due to the speculative nature of managed futures, they are susceptible to **regulatory risk** as governments may unexpectedly tax or restrict futures trading. Managed futures funds often rely on trends to profit. The risk of losses resulting from volatile but trendless markets is known as **lack of trends risk.**

Historical Returns of Managed Futures and Macro Funds

LO 17.8: Demonstrate knowledge of historical performance of managed futures and macro funds.

For example:

- **Recognize inferences that can be drawn from comparing definable characteristics of managed futures and macro investing with their historical stand-alone and portfolio performance.**

Using the HFR Macro Systematic Diversified Index as a proxy for the performance of managed futures from 2000–2014, we can examine the strategy's historical performance. The cross-sectional average returns of managed futures had higher means and higher standard deviations than the larger HFR Macro Index. Both had return distributions that were close to normal. In addition, managed futures had higher returns and lower volatility than global equities. The Sharpe ratios of managed futures were also higher than that of global stocks, global bonds, and commodities.

During this period, managed futures had low to modest correlations with world equities, global bonds, commodities, and credit spreads, and a slight negative correlation with equity volatility. In addition, the conditional return correlations for managed futures with hedge funds and emerging markets were low, indicating diversification potential.

Managed futures also proved to be low-risk based on their low maximum drawdown level. As a result, the addition of a managed futures fund allocation to a traditional stock and bond portfolio would likely result in lower overall risk, higher returns, and improved diversification.

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Key Concepts

LO 17.1

Discretionary strategies allow the trader to use personal judgment in making trades (typically using fundamental analysis), while systematic strategies rely on strict adherence to rules when making trading decisions (technical analysis).

Discretionary trading strategies are preferred by most macro funds, while systematic trading strategies tend to be utilized by managed futures funds.

LO 17.2

Global macro funds are opportunistic in nature, use a top-down approach, and can invest anywhere in the world based on forecasts of economic growth, currency movements, and changes in interest rates. Global macro strategies are most profitable when market events (i.e., exchange rates, interest rates, inflation rates, or other macroeconomic factors) cause increased uncertainty and/or volatility. The three primary risks of global macro funds include market risk, event risk, and leverage risk.

LO 17.3

Historical returns of macro funds reveal excellent risk-adjusted performance with high mean returns, low volatility, high Sharpe ratios, and low to modest correlations with world equities, global bonds, and commodities and slight negative correlations with credit spreads and equity volatility.

LO 17.4

- Managed futures strategies are typically based on technical analysis and allow investors higher return investment opportunities of actively managed future contracts.
- The Commodity Exchange Act (CEA) set standards for financial reporting, disclosure, and recordkeeping.
- Commodity Pool Operators (CPOs) are general partners in a commodity pool, who typically hire professional money managers called Commodity Trading Advisors (CTAs) to manage the funds.
- The managed futures industry comprises three segments: (1) public commodity pools, (2) private commodity pools, and (3) individually managed accounts.

LO 17.5

- Systematic trading refers to black-box or computer-based trading. Models that perform well in backtests often do not perform as well in future periods.
- Statistical analysis is required to validate and test trading patterns for degradation.

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LO 17.6

- Trend-following strategies refer to trading strategies that attempt to exploit predictable price patterns after the trend has begun.
- Non-trend-following strategies attempt to profit from inconsistencies in market prices.
- Countertrend strategies attempt to profit by trading against the current trend.
- Relative value strategies attempt to exploit price inefficiencies between two related futures contracts.
- Buy (sell) when the price is above (below) a simple, weighted, or exponential moving average.
- Common channel breakout strategies indicate a buy (sell) signal is generated when the price is above (below) the upper (lower) bound.
- A relative strength index for future contracts or securities is calculated as:

$$\text{RSI} = 100 - \frac{100}{1 + \frac{U}{D}}$$

- A RSI buy (sell) signal is generated when the RSI < 30 (>70).
- A relative value strategy using an RSI is created by calculating the price difference between two contracts (A and B) over the last *n* days.

LO 17.7

- Managed futures and macro funds had close to normally distributed returns with skewness near zero. They typically have higher standard deviations than most hedge funds but smaller maximum drawdown than equity markets.
- A conceptual rationale for excess returns in managed futures is that CTAs play a valuable role as speculators who provide a service to natural hedgers.
- The six risks associated with managed futures include: transparency risk, model risk, capacity risk, liquidity risk, regulatory risk, and lack of trends risk.

LO 17.8

Managed futures and macro investing strategies have return distributions close to normal with higher returns, higher Sharpe ratios, and lower volatility than global equities. They also have low risk based on the level of maximum drawdowns.

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Concept Checkers

1. Which fund strategy is *most likely* to use fundamental analysis?
   A. Discretionary global macro.
   B. Systematic.
   C. Managed futures.
   D. Systematic global macro.

2. Which of the following strategies is *least likely* to be an inefficiency pursued by global macro funds?
   A. Differences in central bank policies.
   B. Discrepancy between a 10-day moving average and a 45-day moving average.
   C. Business cycle discrepancies between countries.
   D. Political instability.

3. The return distribution of macro funds is:
   A. slightly negatively skewed with leptokurtosis.
   B. positively skewed with leptokurtosis.
   C. negatively skewed with fat tails.
   D. positively skewed with high kurtosis.

4. A general partner in a commodity pool is known as a:
   A. Commodity Executive Adviser (CEA).
   B. Commodity Executive Officer (CEO).
   C. Commodity Trade Adviser (CTA).
   D. Commodity Pool Operator (CPO).

5. The difference between expected entry and exit prices based on the model and actual entry and exit prices is known as:
   A. whipsawing.
   B. degradation.
   C. slippage.
   D. back-testing.

6. Which of the following is **NOT** used to exploit an overbought market?
   A. Countertrend strategies.
   B. Non-trend-following strategies.
   C. Trend-following strategies.
   D. Relative Strength Index.

7. Which of the following is the *most likely* explanation for superior returns in managed future funds?
   A. Future contracts are zero-sum games.
   B. Future contracts have narrow bid-ask spreads.
   C. Equivalent amounts of natural hedgers on either side of the trade.
   D. Speculation by CTAs provides a valuable service to natural hedgers.

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Concept Checker Answers

1. **A** Discretionary fund traders are typically fundamental researchers. They analyze publications from central banks, key confidence indicators, statistics on asset flows, measures of liquidity, and even comments made by politicians. Systematic or managed futures typically rely on technical analysis. (LO 17.1)

2. **B** Differences in moving averages are more likely to be pursued by a managed future fund as an example of technical analysis. Global macro funds tend to pursue strategies that utilize exchange rates, inflation rates, interest rates, or some other macroeconomic factor. (LO 17.2)

3. **A** The return distribution of the macro strategy is close to normal with a small negative skew and leptokurtosis. (LO 17.7)

4. **D** Commodity Pool Operators (CPOs) are the general partners in a commodity pool. (LO 17.4)

5. **C** Slippage is the difference between expected entry and exit prices based on the model and actual entry and exit prices. (LO 17.5)

6. **C** Countertrend (non-trend-following) strategies are used to exploit overbought markets. The Relative Strength Index is used to determine if a market is overbought or oversold. If the market is deemed to be overbought, then a trend-following strategy would not be pursued. (LO 17.6)

7. **D** If there are no natural hedgers on one side of the futures trade, then CTAs can play a valuable role as speculators and earn positive excess returns for providing this service to natural hedgers. (LO 17.7)

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The following is a review of the Hedge Funds principles designed to address the learning objectives set forth by the CAIA Association®.

Event-Driven Hedge Funds

Topic 4.3

Exam Focus

In this topic review, we discuss the attributes of event-driven hedge funds. Candidates should understand the characteristics of the following event-driven hedge funds: activist, distressed securities, merger arbitrage, and multistrategy funds. Event-driven hedge fund managers speculate on security price movements related to events associated with asymmetric information in the markets. Many event-driven strategies have payoffs similar to selling insurance. Thus, return distributions of event-driven strategies are negatively skewed and leptokurtic. Most event-driven strategies have high correlation with traditional assets and, therefore, have limited diversification benefits. The two most common strategies involve mergers and distressed securities. Merger arbitrage strategies seek profits through a long target firm position hedged with a short acquiring firm position. Distressed security funds involve expertise in the bankruptcy process and rely on accurately estimating the recovery values and recovery rate. Candidates should also be familiar with the agendas of each type of activist investor.

The Event-Driven Strategy

LO 18.1: Demonstrate knowledge of the sources of event-driven strategy returns.

For example:
- **Explain the insurance selling view of event-driven strategy returns.**
- **Explain and apply the binary option view of event-driven strategy returns.**

If markets efficiently process new information, then abnormal returns are not possible. However, markets may not immediately react to new information related to special events under unique circumstances. Event-driven fund managers react quickly to capture risk premiums associated with these types of events. The dispersion in economic outcomes due to the uncertainty of corporate events is called **corporate event risk**.

Insurance Perspective

The share price of a target firm often increases as a result of a merger announcement. If the merger actually takes place at some future point in time, prices may slightly increase. Conversely, if the proposed merger fails to take place, then the gains in share price for the target firm associated with the initial announcement may quickly erode. Therefore, existing shareholders of the target firm frequently sell their shares in order to lock in profits resulting from a positive jump in price. Existing shareholders may not be willing to assume the event risk associated with uncertain outcomes of a proposed merger. Event-driven hedge fund managers purchase the target firm's shares after a proposed merger announcement and are willing to take on this event risk.

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Event-driven hedge fund managers seek the risk premium associated with selling insurance against a failed merger deal. The economic process of earning relatively small risk premiums for protection against large losses of unfavorable events is known as **selling insurance.** The event-driven hedge fund manager is often involved in several unrelated merger deals to diversify the event risk. In addition, a merger arbitrage fund manager uses derivatives to help manage exposure to specific large deals. The practice of hedging merger risk is complicated and existing target shareholders may not have the knowledge or desire to hedge the event risk.

Binary Option Perspective

Positions taken by event-driven hedge funds can also be viewed as binary options. A *binary option* is an option where the holder receives full payment or no payment depending on the occurrence of a pre-specified event (e.g., merger completion).

- Under the **binary call option** view, the event-driven fund gains if the merger takes place and the option is in-the-money and loses if the option expires worthless in the event that the merger fails to take place.
- Under the **binary put option** view, event-driven funds write put options and have payouts consistent with writing out-of-the-money options. Out-of-the-money options have the potential for modest gains or large losses.

For example, suppose the shares of a target firm jumped from $50 to $65 a share following a proposed merger announcement. If the merger is completed, assume the share price will increase to $70 per share. However, if the merger fails, the share price will return to $50. An event-driven fund that takes a long position in the target firm could be viewed as either taking a long position in a binary call option or a short position in a binary put option.

- *Long binary call option.* The fund is taking two positions: a long position in a risk-free bond with a face value of $50 and a long binary call option costing $15 with a payoff of $20 if the merger is successful and $0 if it is unsuccessful. The initial cost to the fund manager is $65, with potential payoffs of $50 or $70.
- *Short binary put option.* The fund is taking two positions: a long position in a risk-free bond with a face value of $70 and a short binary put option valued at $5 with a potential payoff of –$20 for the fund if the merger is not successful. Note that because the fund is short the option in this scenario the fund must pay, not receive, the option's payoff value. The initial cost for the fund manager is $65 (= $70 + –$5), with potential payoffs of $50 or $70 depending on the success of the merger.

Professor's Note: Notice that the initial cost and expected payoffs are the same whether the position is viewed as a binary call option or a binary put option.

Long positions in call options on equities typically have higher betas than their underlying stocks. Thus, one could argue that under a long binary call option view of event-driven strategies, the higher returns are compensation for taking higher market risk (higher beta) rather than generating alpha. In addition, mergers are more likely to be successful in bull markets. Thus, some event risk may be systematic. Event-driven strategies are more likely to be profitable during normal or healthy market conditions when deals are realized in a timely manner. Conversely, large losses may occur in the event of a market crisis due to an increased percentage of failed deals.

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The Activist Strategy

LO 18.2: Demonstrate knowledge of activist investing.

For example:

- **Define activist investing, and identify the components of activist investment strategies.**
- **Identify the various roles in corporate governance.**
- **Identify the five dimensions of shareholder activists and the key players in financial activism.**
- **Discuss agency costs and the conflicts of interest between shareholders and managers.**
- **Recognize and discuss approaches commonly used by activist investors to generate alpha.**
- **Recognize inferences that can be drawn from three types of activist agendas, comparing definable characteristics of activist investing with its historical stand-alone and portfolio performance.**

Strategy Components and Corporate Governance

An **activist investment strategy** involves influencing shareholder voting rights to impact corporate governance. **Corporate governance** refers to the management and processes that control decisions of a corporation.

An activist investment strategy involves three components:

1. Identifying corporations that do not maximize shareholder wealth.

2. Investing in positions that benefit from changes in corporate governance.

3. Executing favorable corporate governance changes.

Shareholders are owners of the corporation who elect a board of directors to oversee and delegate an executive management team. Shareholder activism occurs following a divergence between the preferences of shareholders and management. **Shareholder activism** is the process of one or more shareholders influencing the decisions of a firm opposing the recommendation of senior management. For example, a **proxy battle** involves a battle between the corporation's current management and one or more shareholders to influence proxies or votes from shareholders in a particular direction. **Staggered board seats** exist when companies elect members to the board over multiple time periods instead of all at once. This stipulation makes it more difficult for activist investors to earn a large percentage of board seats.

Investors interested in activist activity can follow the public SEC filings of other investors. Therefore, activist investors often try to avoid triggering the rules that require these filings if possible. For example, some activist investors accumulate a **toehold** position (4.9% or less) in order to establish a dialogue with the target company before making their intentions public. Activist investors owning 5% or more in a target firm must file a **Form 13D** with the SEC within 10 days, which discloses the activist's position to the public. **Form 13G** must be filed for investors holding passive stakes in a company of 5% or more, and must be filed within 45 days after the end of the year. **Form 13F** details the long equity positions

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of U.S. firms managing more than $100 million in assets under management and must be filed within 45 days of quarter's end. Note that all three forms (13D, 13G, and 13F) are only required for long positions. Therefore, they may offer an incomplete and delayed representation of an investor's strategy. The positions of respected activist investors can sometimes attract a **wolf pack**, which is a group of like-minded investors that seek to benefit from the activists' engagement with management and enlarge the activists' influence.

Key Players in Financial Activism

The following five categories define different dimensions of shareholder activists:

1. *Financial vs. social activists.* Financial activists seek to increase shareholder wealth by increasing the stock price. Social activists seek changes in corporate behavior to benefit society (e.g., reduced pollution or improved treatment of employees). Financial activists will be the focus of this topic review.

2. *Activists vs. pacifists.* Activists seek major changes or replacement of management. Pacifists oppose the proposed changes to management that activists are seeking.

3. *Initiators vs. followers.* Shareholders may initiate or follow activism. Initiators pay the direct expenses of activism, such as creating and conducting takeover plans.

4. *Friendly vs. hostile.* Friendly activists work with management to improve conditions, while hostile activists threaten management with potential punishment if conditions do not improve. Activists may choose to address management publicly using the media, which may draw other major shareholders into the discussion.

5. *Active vs. passive.* Active activists establish stock positions with the intent of activism. Passive activists are existing shareholders who participate in activism most likely as followers.

The *key players* in financial activism are *active initiators*, *active followers*, and *passive followers*. Active initiators are catalysts for change and pay the direct costs of activism. Active initiators typically need to involve other shareholders to get enough voting power to change the firm's policies. However, they must be aware of regulations such as required disclosures if they are working explicitly in groups.

Active followers are **free riders** (i.e., someone who allows others to pay initial costs and benefits from those actions) but support the active initiators in their efforts. Passive followers are existing shareholders who may either support the activists' proposals as followers or oppose activists as pacifists. Pacifists support current management and are key players in failed attempts of financial activism. Note that individual shareholders votes can be viewed by corporate management. As a result, some shareholders may choose to be pacifists in order to avoid the ramifications of an unsuccessful takeover.

Agency Problems

Conflicts of interest between shareholders and managers arise from managers seeking goals that differ from shareholders' goals. The study of the relationship between principals (shareholders) and agents (management team) is called **agency theory**. The **principal-agent relationship** forms when one individual/group (principal) hires another individual/group (agent) to act on his (or its) behalf in making decisions.

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One aspect of agency theory is to design management compensation that is aligned with the interests of shareholders. The **agent compensation scheme** involves all agreements regarding payments to management for services rendered. **Agency costs** are all direct or indirect costs associated with conflicts of interest between shareholders and management. There are two types of agency costs. The first type involves the costs of aligning the interests of shareholders and managers in a cost-effective way. The second type of agency costs to the shareholders involves unresolved conflicts of interest between the shareholders and management.

Examples of agency costs resulting from unresolved conflicts of interests include:

- Managers who become overly risk-averse in order to maintain job security.
- Managers who receive extra compensation in the form of managing the corporation for personal benefits rather than shareholder benefits.
- Managers making decisions in their own best interest.
- Managers that take excess risk with disproportional upside benefits to the manager if the strategy is successful and little personal cost if the risk materializes.
- Managers that minimize their workload at the expense of optimal operational change.
- Managers that avoid conflicts that can arise from unions or firing employees.

Examples of Alpha Generation from Three Types of Activist Agendas

One example of how an activist investor attempts to generate alpha (i.e., unlock value) is illustrated by a closed-end mutual fund that is traded at a substantial discount to net asset value. In this situation, activists would establish a position by buying equity in the mutual fund. Then the activists inform management that the mutual fund should be liquidated at market values. If the fund is liquidated in a timely manner (i.e., before values change), the activist will earn substantial profits. In the following section, we examine three types of agendas that may be pursued by activists in order to increase shareholder wealth.

Activists Agenda #1: Management, Compensation, and Board of Directors

When board members or managers serve on multiple firms and boards simultaneously, it is referred to as **interlocking boards**. A CEO may be the chairman of the board, or the board may have developed a close personal relationship with management. This could result in shareholder conflicts of interest. For example, in 2006, the Board of Directors for UnitedHealth granted CEO William McGuire $1.6 billion in backdated stock options. Activists led a class action lawsuit and $900 million was returned to shareholders. In addition to forfeiting many of his options, McGuire was fined by the Security Exchange Commission (SEC) and prohibited from serving as a corporate director or officer for 10 years.

Activists Agenda #2: Capital Structure and Dividend Policy

Managers may make choices that provide them more job security at the expense of shareholders. Managers could diversify the firm's assets to provide job security even if it does not maximize shareholder wealth. Managers may use retained earnings of the firm to reinvest in new business opportunities at lower returns, rather than use the cash to pay dividends or buyback stock. Activists may demand increases in dividends or stock buybacks to increase shareholder wealth.

Activists may also seek increased leverage in the form of debt for the firm to increase the return on equity to shareholders. Leverage increases bankruptcy risk, but it is also the lowest

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cost of capital because the after-tax cost of debt is substantially less than the cost of equity. Shareholders may benefit from taking more risks because equity can be viewed as a call option. Shareholders can receive full benefits of gains when taking excess risk pays off, but they have limited liability in the event of bankruptcy. In addition, under-levered companies can become targets of activism or acquisitions.

Activists Agenda #3: Mergers or Divestitures

If a corporation has a division or business unit that is not maximizing shareholder wealth, an activist can encourage the corporation to sell, spin-off, or split-off the business. In a **spin-off**, an investor retains shares in both companies while a **split-off** forces an investor to choose shares in either one or the other. When McDonald's (MCD) split-off Chipotle Mexican Grill (CMG), MCD shares increased 300% and CMG increased 1,200% in the eight years following the split-off. Activists may also try to separate hard assets from intellectual property to maximize shareholder wealth. Benefits can include reduced agency costs or a clientele effect if some shareholders prefer to invest in specific business units.

Examining Historical Performance

Based on return data from 2005–2014, the historical annual returns of activist funds are very high (8.3%) with moderately high volatility (14%) leading to a modest Sharpe ratio (0.47). The returns of both activist funds and all event-driven funds were negatively skewed and leptokurtic. Activist funds had high correlations with global equities (0.86), commodities (0.56), and high-yield bonds (0.69); low correlations with global bonds (0.28); and negative correlations with equity volatility (–0.60) and credit spreads (–0.38). Historically, event-driven funds have consistent positive correlations with global equities, U.S. high-yield bonds, commodities, and negative correlations with credit spreads and equity volatility.

The Merger Arbitrage Strategy

LO 18.3: Demonstrate knowledge of merger arbitrage.

For example:

- **Recognize the characteristics of merger arbitrage.**
- **Recognize the characteristics of stock-for-stock mergers.**
- **Discuss and apply traditional merger arbitrage to stock-for-stock mergers.**
- **Discuss the effects of third-party bidders and bidding wars on merger arbitrage.**
- **Describe regulatory risk in the context of merger arbitrage.**
- **Describe financing risk in the context of merger arbitrage.**
- **Recognize inferences that can be drawn from comparing definable characteristics of merger arbitrage with its historical stand-alone and portfolio performance.**

One of the most common event-driven strategies is **merger arbitrage**. A merger can occur by acquiring shares of the target firm with cash, an exchange of shares, or some combination of the two. **Stock-for-stock merger proposals** typically result in large initial increases in the target firm's share price. If the merger is successful, the target firm normally has moderate increases in share price from the time of the announcement until the merger. However, if the proposed merger fails, it will often result in relatively larger losses for the target firm's

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share price. Merger arbitrage speculators in equity exchange mergers take offsetting hedged positions in the shares of the target and acquirer based on the ratio of shares in the merger.

Traditional Merger Arbitrage

In a **traditional merger arbitrage**, leverage is generally used to buy stock of the target firm and short sell stock in the acquiring firm. This strategy can only be implemented using companies with sufficient liquidity to establish short positions in the acquiring firm. Event risk is created from the long target stock and short acquirer stock positions. The merger arbitrager should be compensated for bearing the event risk of a failed merger. Thus, superior returns in excess of risk premiums are gained by identifying undervalued target firms. This can result from existing shareholders who do not desire to take on event risk and sell their shares to lock in the profits generated by the merger announcement.

Traditional merger arbitrage is similar to insurance underwriting. A premium is gained for taking on event risk and large losses can occur in the event the merger is not successful. The success of the arbitrage relies more on whether or not the deal goes through than it does on market factors. However, during periods of market downturns, deals are more likely to fail.

Stock-for-Stock Merger Example

The simplest type of merger arbitrage involves a stock-for-stock exchange. For example, suppose a firm with stock currently trading at $70 a share offers two shares of its stock for one share of the target firm. The target firm's share price increases from $120 to $130 as a result of the proposed merger announcement. The traditional merger arbitrage fund would buy the $130 target firm stock with proceeds from selling short two shares of the acquiring firm's stock for $140. The merger offer (i.e., two shares of the acquirer per share of the target) determines the hedge ratio.

The merger arbitrage fund anticipates earning a $10 gain if the merger takes place reflecting the offer price of $140 in stock value. As long as the merger is successful as originally structured, the arbitrageur's profit is completely protected from changes in the share prices of both firms. Conversely, if the merger fails, the arbitrageur loses $10 if the target firm returns to its initial price of $120 and could lose more if the acquiring firm's stock price increases.

Merger Arbitrage Bidding

When more than one firm competes to acquire the same target firm, a **bidding contest** begins. A traditional merger arbitrage position benefits from a bidding war as the price of the target firm increases. Because the traditional merger arbitrage has a long position on the target firm, the arbitrageur profits from the higher offer. However, this can be a challenging type of trade for merger arbitrage funds as the potential scenarios become much more numerous and complex. In addition, both bidders may decide to walk away from the deal, which would cause the price of the target firm to decrease dramatically to its pre-merger price.

Regulatory and Financing Risks

The primary sources of event risk in merger arbitrage are related to regulatory risk and financing risk.

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Regulatory risk refers to the uncertainty regarding the decisions made by regulators who may not approve a merger. U.S. and foreign regulatory agencies may not approve the merger if they are concerned that it would significantly reduce competition for a given market. Regulators may approve, reject, or make a conditional approval of a merger after an **antitrust review**. Conditional approvals may require the divestiture of some assets to limit the firm's market share. Regulators can also disallow deals placed by foreign corporations for nationalistic or tax-related reasons. Thus, merger arbitrage fund managers are required to determine the probability of the outcome of antitrust concerns prior to the rulings of the regulators in order to earn excess returns. In stock-for stock-merger deals, merger arbitrageurs focus more on regulatory risk.

Financing risk refers to the uncertainty regarding the ability of the acquiring firm to obtain funding needed to consummate a merger. When a deal is contingent on an acquiring firm obtaining financing, merger arbitrageurs are more focused on financing risk. Financing risk is a greater concern in employee buyout deals and leveraged buyouts.

Examining Historical Performance

Based on return data from 2000–2014, the average Sharpe ratios for merger arbitrage funds were very high (0.93) as a result of moderately high annual returns (5.2%) and very low volatility (3.2%). The return distribution was negatively skewed and leptokurtic, similar to other event-driven strategies. Merger arbitrage funds had moderate correlations with global equities (0.60), high-yield bonds (0.56), and commodities (0.36); low correlations with global bonds (0.13); and negative correlations with equity volatility (–0.50) and credit spreads (–0.27).

The Distressed Securities Strategy

LO 18.4: Demonstrate knowledge of distressed securities hedge funds.

For example:

- **Distinguish between distressed debt strategies in hedge funds and in private equity.**
- **Identify key components of the bankruptcy process.**
- **Define a naked option position.**
- **Describe the risks and returns of short sales of distressed equities.**
- **Determine the effect of recovery values on annualized returns for a strategy of buying undervalued debt during the bankruptcy process.**
- **Recognize activist approaches to investing in distressed securities.**
- **Describe the characteristics of capital structure arbitrage.**
- **Explain the strategy of buying distressed firms using distressed securities.**
- **Recognize inferences that can be drawn from comparing definable characteristics of distressed securities funds with their historical stand-alone and portfolio performance.**

Hedge Funds vs. Private Equity

Distressed debt hedge funds invest in securities of corporations in bankruptcy or corporations with a high risk of bankruptcy risk. Some of these strategies overlap with **distressed debt private equity strategies** that involve firms with too much leverage, poor

operating performance, or accounting issues. However, private equity investors take a long-term view on the value and reorganization of the corporation, whereas distressed security hedge funds typically take a short-term view on distressed corporations.

The Bankruptcy Process

The **bankruptcy process** allocates the assets of the firm to debt and equity stakeholders of the firm when liabilities exceed the market value of assets. First, senior debt holders of secured or collateralized debt are paid. Next in line are junior debt holders followed by unsecured debt holders. Preferred equity holders and common shareholders are paid last if there are any remaining funds. If *Chapter 7 bankruptcy* is declared, then a **liquidation process** takes place where all remaining assets of the firm are sold and proceeds are distributed to stakeholders. If *Chapter 11 bankruptcy* is declared, a **reorganization process** is put into place with the goal of reorganizing the firm so that it can continue operations after the bankruptcy proceedings are complete.

There are a limited number of institutions willing to hold distressed securities. This adds to the information asymmetries that lead to inefficient market prices. Distressed securities are often referred to as one-off transactions. The term **one-off transaction** refers to the unique characteristics of the transactions that require expert knowledge, skill, or effort. Many institutions are not allowed to hold investments in distressed firms and will sell shares causing a downward spiral in prices. This can lead to excess alphas for distressed debt hedge funds.

Short Sales of Distressed Equities

One strategy used by distressed hedge funds is to identify firms that are likely to end in liquidation, prior to their announcement of bankruptcy. The first step involves an analyst identifying financially distressed publicly traded companies. Bankruptcy filings usually result in the share price declining. The most straightforward strategy is to short the stock of the distressed company. The hedge fund manager does this by borrowing stock from its broker and selling the stock. This is similar to a **naked call option position** where an investor is short a call option and does not own the underlying asset. The manager expects to buy the stock later at a much lower price as the company's financial situation worsens and the probability of declaring bankruptcy increases. Thus, this strategy is nothing more than attempting to sell high and buy low.

The distressed hedge fund is exposed to a significant amount of risk if the company is able to turn things around and avoid bankruptcy filings. For example, American Airlines traded below $2 in March of 2003, in response to the bankruptcy filings of United Airlines and US Airways. Ford traded below $2 in November of 2008 in response to the financial distress of General Motors. Distressed hedge funds who expected them to proceed to bankruptcy established short positions in their stocks. If the companies went bankrupt, the stock price would approach $0 and the gain would be $2 per share. However, in less than one year, both stocks traded above $11 a share, potentially resulting in a $9 per share or more loss for the distressed hedge funds. This is an example of a naked call option position, which illustrates the negative skew in the return distribution, with the potential for large losses.

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Recovery Value

Many institutional investors, such as insurance companies or pension plans, are prohibited from owning non-investment grade bonds due to restrictions imposed by regulators regarding the credit quality of the institutions' portfolios. This can result in poor market liquidity for debt securities of financially distressed firms, allowing distressed hedge funds to gain alpha returns in addition to the systematic risk premium for market risks.

The challenge for the distressed hedge fund manager is to estimate the probabilities of various outcomes for distressed firms. The **recovery value** of the firm is based on the value of each security in the firm and the amount of time it will take the firm to emerge from bankruptcy. The probabilities associated with the value and recovery time are difficult to estimate because they vary for each specific firm. The **recovery rate** for a bond is the amount of the face value that an investor receives following the bankruptcy proceedings. Bonds with higher seniority are paid first and often have higher recovery rates than subordinate bonds. Unfortunately, the market conditions for the industry are often unfavorable for distressed firms. This adds to the difficulty of obtaining a fair price for the bankrupt firm in a short period of time.

There is also a great deal of uncertainty regarding how long the bankruptcy process will take and when the bankruptcy will be declared. For example, suppose a distressed hedge fund predicts that a distressed firm will not file for bankruptcy for at least one year. If the market believes it will occur in a shorter time horizon, the hedge fund can profit by buying debt issues with less than one year until maturity and short selling debt issues with more than one year until maturity.

Example: Recovery value

An endowment purchases a zero-coupon bond at 50% of its face value. The bond immediately defaults due to its issuer filing bankruptcy. Within two years, the endowment recovers 38% of bond's face value. Ignoring compounding, **calculate** the annualized rate of return earned by the endowment on this investment.

Answer:

Total return = (38% / 50%) – 1 = –24%

Annualized return = –24% / 2 = –12%

Activist Approach

Activist investors in distressed securities attempt to influence the recovery value and the timing of the exit from the bankruptcy process. The distressed hedge fund manager must possess legal expertise as the manager works with investors and the court in the bankruptcy negotiations. The activists may try to expedite the process. Conversely, an activist may not cooperate in the bankruptcy process if the hedge fund's position may be improved by a delayed bankruptcy decision.

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Capital Structure Arbitrage

Simple long-only positions or short-only positions in distressed firms are unhedged and subject to substantial idiosyncratic and systematic risks. **Capital structure arbitrage** refers to offsetting positions within a company's capital structure. The goal is to hold a long position in relatively undervalued securities and a short position in relatively overpriced securities in the same firm, resulting in a hedged position. Derivative securities of a company can provide increased opportunities for arbitrage within a company's capital structure when **financial market segmentation** occurs. This refers to times (especially in bankruptcy) when groups of stock and bond market participants have different appraisals of a firm's prospects.

A traditional capital arbitrage strategy is to buy the senior secured debt and short sell junior debt. Another strategy is to buy preferred stock and short sell common stock of the distressed firm. In both cases, the long position receives proceeds in the event of bankruptcy prior to the short position. The payoff is determined by the relative movements of the constituent positions. The following scenario and the potential outcomes illustrate the potential gains and losses of a hedge fund that employs this strategy.

Assume that a hedge fund has an $80,000 long senior debt position and an $80,000 short junior debt position in a financially troubled firm.

- Under the worst-case scenario for the firm, no assets are recovered in bankruptcy and the hedge fund breaks even by losing $80,000 on the long position and gaining $80,000 from the short position.
- If the senior debt is fully recovered and the junior debt has no recovery, the fund earns the largest payout as it profits from both sides of the trade.
- If recovery rates are equal for senior and junior debt, then the hedge results in a net loss as junior bonds gain more than expected.
- Under the best-case scenario for the distressed firm, assets are fully recovered in bankruptcy and the hedge fund loses money because the loss on the short position exceeds the gain on the long position.

Thus, the relative movement of the two positions determines the payoff. Senior claims often have the highest loss potential and lowest profit potential relative to junior claims. The use of derivatives can make the potential payoffs and risks even higher.

Buying Distressed Firms

If a distressed hedge fund manager believes a distressed firm is substantially undervalued, the manager may try to establish a controlling position in the firm during bankruptcy. This is an example of a case where distressed hedge funds overlap private equity. The distressed hedge fund must understand the bankruptcy process in order to successfully restructure the firm and profit from its position. This strategy is much more complex to successfully execute than simply trying to earn short-term gains from a bankruptcy event.

Examining Historical Performance

Based on return data from 2000–2014, distressed hedge funds achieved excellent Sharpe ratios (0.96) from high returns (8.1%) and low volatility (6.2%). Similar to other event-driven strategies, the return distribution for the distressed strategy was negatively skewed and leptokurtic. There were also consistent positive correlations of distressed funds with global equities (0.66), U.S. high-yield bonds (0.70), commodities (0.44), low correlations with global bonds (0.14); and negative correlations with credit spreads (–0.54) and equity volatility (–0.47).

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Event-Driven Multistrategy Funds

LO 18.5: Demonstrate knowledge of event-driven multistrategy funds.

For example:
- **Describe key characteristics of event-driven multistrategy funds.**
- **Recognize inferences that can be drawn from comparing definable characteristics of event-driven multistrategy funds with their historical stand-alone and portfolio performance.**

Event-driven multistrategy funds diversify across various event-driven strategies including corporate debt and equity securities. Merger activities are more frequent in normal and strong markets, and debt defaults are more frequent in down markets. Thus, these strategies are countercyclical and diversification benefits are gained by combining these strategies into a single fund. This helps to improve the capacity of the fund and smooth out the opportunity set over time and through changing market conditions. Special situation funds also invest across a number of event styles. However, **special situation funds** typically focus more on equities involved in mergers, spin-offs, or bankruptcies.

Examining Historical Performance

Based on return data from 2000–2014, event-driven multistrategy hedge funds achieved a high Sharpe ratio (0.89) due to high returns (7.7%) and low volatility (6.2%). Similar to other event-driven strategies, the return distribution for multistrategy funds was negatively skewed and leptokurtic. There were also consistent positive correlations of event-driven multistrategy funds with global equities (0.68), U.S. high-yield bonds (0.60), and commodities (0.47); low correlations with global bonds (0.15); and negative correlations with credit spreads (–0.41) and equity volatility (–0.50).

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Key Concepts

LO 18.1

Event-driven strategies have similar payoffs to insurance and binary options.

- The economic process of earning relatively small risk premiums for protection against large losses of unfavorable events is known as selling insurance.
- Under the binary call option view, the event-driven fund gains if the event takes place and the option is in-the-money and loses if the event fails to occur and the option expires worthless.
- Under the binary put option view, event-driven funds write put options and have payouts consistent with writing out-of-the-money options.

LO 18.2

An activist investment strategy involves:

- Identifying corporations that do not maximize shareholder wealth.
- Investing in positions that benefit from changes in corporate governance.
- Executing favorable corporate governance changes.

The following categories distinguish between different types of shareholder activists:

- Financial vs. social activists.
- Activists vs. pacifists.
- Initiators vs. followers.
- Friendly vs. hostile.
- Active vs. passive.

The key players in financial activism are active initiators, active followers, and passive followers.

Agency costs are all costs associated with conflicts of interest between shareholders and management.

Three common agendas for activists are related to:

1. Management compensation and interlocking board of directors.

2. Capital structure and dividend policy.

3. Mergers and divestitures.

The historical returns of activist funds are very high with moderately high volatility.

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LO 18.3

- Traditional merger arbitrageurs use leverage to buy stock of the target firm and short sell stock in the acquiring firm.
- Regulatory risk refers to the uncertainty regarding the decisions made by regulators who may not approve a merger.
- Financing risk refers to the uncertainty regarding the ability of the acquiring firm to obtain funding needed to consummate a merger.

The Sharpe ratio for merger arbitrage funds was very high as a result of moderately high returns and very low volatility. Similar to other event-driven strategies, the return distribution was negatively skewed and leptokurtic. Event-driven funds have consistently positive correlations with global equities, U.S. high-yield bonds, and commodities; and negative correlations with credit spreads and equity volatility.

LO 18.4

- Distressed debt hedge funds invest in securities of corporations in bankruptcy or corporations with a high risk of bankruptcy.
- A naked call option position occurs when an investor is short a call option and does not own the underlying asset.
- The challenge for the distressed hedge fund manager is to estimate the probabilities of various outcomes related to the recovery rate and recovery value.
- Activist investors in distressed securities attempt to influence the recovery value and the timing of the exit from the bankruptcy process.
- Capital structure arbitrage refers to holding a long position in relatively undervalued securities (senior debt or preferred stock) and a short position in relatively overpriced securities (junior debt or common stock), resulting in a hedged position.
- If a distressed hedge fund believes a distressed firm is substantially undervalued, they may try to establish a controlling position in the firm during the bankruptcy process.
- The cross-sectional average returns of distressed hedge funds reveal excellent Sharpe ratios from high returns and low volatility.

LO 18.5

- Event-driven multistrategy funds use countercyclical event-driven strategies to gain diversification benefits by combining these strategies into a single fund.
- Returns of event-driven multistrategy funds have been consistent with other event-driven funds (i.e., high Sharpe ratio due to high returns and low volatility).

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Concept Checkers

1. Event-driven strategies often have return distributions that are negatively skewed and leptokurtic. These characteristics imply event-driven strategies are similar to:
   A. buying insurance.
   B. selling insurance.
   C. buying put options.
   D. selling call options.

2. Which of the following actions is *least likely* to be part of an activist investment strategy?
   A. Identifying corporations that do not maximize shareholder wealth.
   B. Investing in positions that benefit from changes in corporate governance.
   C. Executing favorable corporate governance changes.
   D. Establishing a short position in a target firm of a potential merger.

3. Suppose a firm with stock currently trading at $11 per share offers three shares of its stock for one share of the target firm. The target firm's share price increases from $23 to $29 as a result of the proposed merger announcement. A traditional merger arbitrage strategy would:
   A. buy one share of target firm and short sell three shares of the acquiring firm.
   B. buy three shares of target firm and short sell one share of the acquiring firm.
   C. buy one share of the acquiring firm and short sell three shares of the target firm.
   D. buy three shares of the acquiring firm and short sell one share of the target firm.

4. Suppose a hedge fund establishes a traditional capital structure arbitrage strategy that has a $10,000 long senior debt position and a $10,000 short junior debt hedged position. The hedge fund will earn the highest returns if:
   A. no assets are recovered in bankruptcy.
   B. all firm assets are fully recovered in bankruptcy.
   C. senior debt is fully recovered and the junior debt has no recovery.
   D. recovery rates are equal for senior and junior debt.

5. Event-driven multistrategy funds often employ strategies to increase capacity and smooth outcomes over time by choosing strategies that are:
   A. countercyclical.
   B. diversified across regions and countries.
   C. diversified across time.
   D. unrelated to market conditions.

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Concept Checker Answers

1. **B** Selling insurance results in higher probability of small profits with occasional large negative returns when an unfavorable event occurs. This results in return distributions that are negatively skewed and leptokurtic. (LO 14.1)

2. **D** While it is possible that an activist would establish a short position in a target firm and then actively try to disrupt the merger, it is not common or likely. Merger arbitrage strategies typically establish long positions in target firms. (LO 14.2)

3. **A** A traditional merger arbitrageur would establish a hedge strategy by buying one share of target firm stock with proceeds from every three short sales of the acquiring firm's stock. (LO 14.3)

4. **C** The payoff is determined by the relative movements of the constituent positions. The largest profits are gained if the senior debt is fully recovered and the junior debt has no recovery. The hedge fund will earn large profits from both sides of the trade. (LO 14.4)

5. **A** Event-driven multistrategy funds often employ strategies to increase capacity and smooth outcomes over time by choosing strategies that are countercyclical. For example, mergers are more active with positive outcomes in up markets and distress debt occurs more in down markets. (LO 14.5)

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The following is a review of the Hedge Funds principles designed to address the learning objectives set forth by the CAIA Association®.

Relative Value Hedge Funds

Topic 4.4

Exam Focus

This topic review focuses on relative value arbitrage strategies, which attempt to take advantage of relative pricing discrepancies between two securities. Candidates should be able to explain the classic relative value strategies and associated terminology. The complexity of analyzing the values of complex securities, such as convertible bonds and asset-backed securities, creates asymmetric information and temporary price discrepancies that attract arbitrageurs. Volatility arbitrage strategies attempt to capitalize on differences in the implied volatility that exists between option prices on a particular stock. Fixed-income arbitrage strategies rely on a mispricing between two securities that is expected to correct itself as the prices of the two securities converge to their par values at maturity. Spread trades involve two fixed-income securities with identical maturities where one security is mispriced relative to the other. Yield curve trades involve trading bonds with different maturities speculating the yield curve will flatten, become more steeply sloped, or change in curvature. Relative value multistrategies combine various strategies to increase fund capacity, increase diversification, and increase opportunities for investment due to the cyclical nature of markets.

Relative Value Strategies

LO 19.1: Demonstrate knowledge of relative value strategies.

For example:

- **Recognize the relative value strategy, and list four styles of relative value hedge funds.**
- **Describe the classic relative value strategy trade.**

Relative value strategies attempt to predict changes in spreads between related prices or rates. For example, one relative value strategy may try to anticipate a narrowing in the spread between gasoline and oil prices. Relative value strategies establish hedged positions with a long position on one security and a short position on a related security. Therefore, the strategy has very little market risk and tends to profit during normal market conditions when valuations converge to their equilibrium prices. **Convergence** refers to the process of prices or rates returning to relative values under normal conditions. These price and rate movements are often very small, so managers use leverage to increase the fund's returns.

In this topic review, we will examine four styles of relative value hedge funds: convertible bond arbitrage, volatility arbitrage, fixed-income arbitrage, and relative value multistrategy funds. According to Hedge Fund Research (HFR) relative value hedge funds held more than a quarter of all assets under management in the hedge fund industry at the end of 2014. Among the four relative value styles, convertible arbitrage funds accounted for $50 billion, volatility arbitrage funds account for $14 billion, fixed-income arbitrage funds (which

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consist of corporate bond strategies, sovereign bonds, and asset-based securities) accounted for $274 billion, and relative value multistrategy funds (which mixes relative value styles) accounted for nearly $460 billion.

Classic Relative Value Strategy Trade

The **classic relative value strategy trade** identifies abnormal spreads between two related prices or rates and establishes a position anticipating convergence to normal levels. A long position is established in the security that is undervalued, and a short position is established in the related overvalued security. The fund manager typically estimates long-term normal relationships using empirical or theoretical models. Because the positions are set to converge to normal levels, the strategies perform well under normal market conditions with low volatility.

Large losses are associated with market crises where investors exhibit flight-to-quality behavior as volatility increases and credit spreads widen. As a result, relative value hedge funds, which depend on price or rate convergence, can potentially suffer significant losses during a crisis. However, HFR, which tracks different hedge fund strategies, found that six of the eight strategies with the highest percentage of winning months over a five-year period ending in the third quarter of 2014 were relative value strategies.

Convertible Bond Arbitrage

LO 19.2: Demonstrate knowledge of convertible bond arbitrage.

For example:

- **Define and describe the classic convertible bond arbitrage trade.**
- **Define convertible bonds, and apply the unbundling approach for pricing convertible bonds.**
- **Define busted, hybrid, and equity-like convertibles.**
- **Define, describe, and apply the concept of delta.**
- **Define and describe the concept of gamma and theta.**
- **Explain and determine the effects of gamma and volatility on the profitability of a delta-neutral position.**
- **Discuss short selling in the context of convertible arbitrage.**
- **Recognize the role complexity plays in making convertible bond arbitrage attractive to some hedge fund managers.**
- **Identify the four reasons that issuers may continue to offer convertible bonds at attractive prices.**
- **Identify the components of convertible arbitrage returns.**
- **Recognize and discuss return drivers and risks of convertible bond arbitrage.**
- **Recognize inferences that can be drawn from comparing definable characteristics of convertible arbitrage funds with their historical stand-alone and portfolio performance.**

Classic Convertible Bond Arbitrage Trade

The **classic convertible bond arbitrage trade** involves the purchase of a company's convertible bonds with the simultaneous short sale of the company's common stock. By short selling the stock, the hedge fund manager eliminates some or all of the equity

exposure present in the convertible bond. The manager receives any interest paid by the bond in excess of dividends paid to the lender of the shorted common stock.

Convertible Arbitrage Terminology

The owner of a convertible bond has the right to exchange the bond into a fixed number of common shares of the issuer. Hence, a **convertible bond** is a hybrid corporate security that includes an embedded call option giving the bondholder the right to receive the common stock of the issuer.

$$\text{convertible bond value} = \text{straight bond value} + \text{call option value}$$

The **conversion ratio** is the number of common shares for which a convertible bond can be exchanged. For example, a convertible bond issued at par with a conversion ratio of 10 allows its holder to convert one $1,000 bond into 10 shares of common stock.

The **option strike price** is the convertible bond face value divided by the conversion ratio.

$$\text{option strike price} = \frac{\text{convertible bond face value}}{\text{conversion ratio}}$$

The **conversion value** is the conversion ratio multiplied by the market price of the issuer's stock. For a convertible bond with a conversion ratio of 10 and a stock price of $65, the conversion value is $65 × 10 = $650.

$$\text{conversion value} = \text{conversion ratio} \times \text{stock price}$$

If the market value of the bond is greater (less) than the conversion value, the bond is said to be trading at a premium (discount) to conversion value. Thus, the **conversion premium** is calculated as follows:

$$\text{conversion premium} = \frac{\text{convertible bond price} - \text{conversion value}}{\text{conversion value}}$$

Convertible bonds can be valued using the **unbundled approach**, which divides the convertible bond into its debt security and equity call option components. The following example demonstrates how this approach is used.

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Example: Unbundled approach to convertible bond valuation

Suppose a firm has unsecured debt with a yield to maturity of 9% and the firm's stock currently trades at $50. The firm can issue 4-year convertible bonds at an annual coupon rate of 4.5% and a conversion ratio of 16. Assuming the bonds sell at $1,000 par, the option strike price will be $62.50 (= $1,000 / 16). Holders of the convertible bond can convert the bond into 16 shares of the firm's stock any time prior to maturity of the bonds. Assume that a 4-year European-style call option with a current stock price of $50, strike price of $62.50, and similar volatility and other parameters is valued at $6.24 using the Black-Scholes option pricing model.

Calculate the value of the convertible bond using the unbundled approach and **determine** the conversion premium.

Answer:

The value of a convertible bond is determined by unbundling the structure into its component parts of straight debt and the equity call option.

The value of the bond component is:

I/Y = 9% (YTM of corporate's outstanding bond), PMT = 45 (coupon rate × $1,000), FV = $1,000, N = 4 (assuming annual payments), CPT→PV = $854.21

The value of the equity call component is:

16 × $6.24 = $99.84

The convertible bond price is simply the sum of the bond and equity call components:

convertible bond price = $99.84 + $854.21 = $954.05

To calculate the conversion premium, we need to determine the conversion value and use the conversion premium formula:

conversion value = 16 × 50 = $800

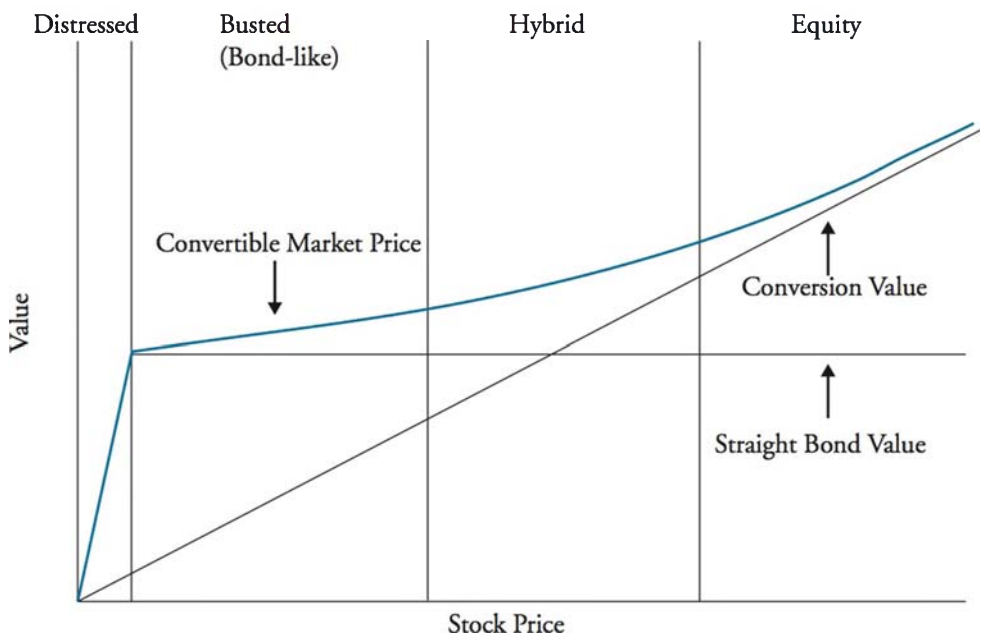
$$\text{conversion premium} = \frac{\$954.05 - \$800}{\$800} = 19.26\%$$

Moneyness

The **moneyness** of convertible bonds refers to the relationship of the conversion option or strike price and the current price of the underlying stock. Moneyness is used in reference to the equity call options being in-the-money, at-the-money, or out-of-the money:

- A **busted convertible** is a bond with a very high conversion premium, indicating the embedded stock options are far out-of-the-money. The value of these bonds is similar to straight debt as the embedded option has very little value.
- **Hybrid convertibles** are convertible bonds with moderately sized conversion ratios and stock options that are close to being in-the-money. Hybrid convertibles have asymmetric payoff profiles and are, therefore, more popular for convertible arbitrage strategies. The convexity of hybrid convertibles plays an important role in arbitrage strategies.
- **Equity-like convertible** bonds are in-the-money and, therefore, have characteristics that more closely resemble the underlying stock. Thus, interest rates and credit spreads do not have as much impact on equity-like convertible bonds.

Figure 1: Moneyness of Convertible Bonds



The Greeks

Convertible arbitrageurs must pay close attention to the so-called Greeks for their positions:

- **Delta** is the change in value of an option with respect to a change in the value of the underlying asset. For example, if a call option has a delta of 0.7, then a $1 change in the underlying stock will cause a $0.70 change in the call option. Deltas of options far out-of-the money are close to 0, and deltas of options deep in-the-money have deltas close to 1. Delta is used to establish the hedge ratio used in arbitrage strategies. Delta is the first derivative of an option's price with respect to the price of the underlying asset.
- **Gamma** is the second derivative of an option's price with respect to the underlying price of the asset. The second derivative measures how delta changes with changes in the price of the underlying asset. The gamma determines the curvature in the graph representing the relationship between the option price and the price of the underlying stock.

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- **Theta** is the first derivative of an option price with respect to the time to expiration for the option. Theta is negative for a long position in an option because the value of the option decreases as time expires. Theta captures the loss of value in hedged positions with no changes in the underlying asset or volatility.

The price changes for convertible bonds are nonlinear due to convexity. Thus, large price changes in the price of the underlying equity will result in a larger change in the convertible bond price due to the convexity of the relationship. Therefore, gamma and theta are essential to determine if a delta-neutral position will earn a profit. For instance, suppose a convertible bond with a face value of $1,000 can be converted into one share of stock currently selling for $900. Figure 2 represents the price changes in the convertible bond relative to the price change of the underlying stock.

Figure 2: Example of Delta-Neutral Position for Convertible Bond Arbitrage With Delta = 0.5

Stock price	$840	$870	$900	$930	$960
Short 0.5 shares of stock	–$420	–$435	–$450	–$465	–$480
Convertible bond price	$925	$935	$950	$965	$985
Long 1 bond and short 0.5 equity	$505	$500	$500	$500	$505

In Figure 2, notice that if the stock price rises (falls) $30, the bond price increases (decreases) $15. Thus, the delta is 0.50 (= $15 / $30) and the hedged position is long 1 convertible bond and short 0.5 shares of stock. This is referred to as a **delta-neutral position,** as the value-weighted sum of all deltas for all positions equals 0. The hedged positions will offset each other for small moves in the stock price.

A key consideration with **delta-neutral hedging** is that the delta-neutral position only holds for very small changes in the value of the underlying stock. Hence, the delta-neutral portfolio must be frequently (continuously) rebalanced to maintain the hedge. As the underlying stock price changes, so does the delta of the convertible bond. When delta changes, the **net delta**, which is the difference between the delta of long positions and the delta of short positions, will no longer be 0. Therefore, as the delta of the convertible bond increases, the number of stocks that need to be sold to maintain the delta-neutral position increases. Conversely, as the delta of the convertible bond decreases, the number of stocks needed to maintain the hedge must be reduced by buying back stock.

For example, consider that the delta in the last example increases from 0.5 to 0.625 when the stock price increases. In this case, the short stock position needed to hedge 1 long convertible bond would increase from 0.5 shares to 0.625 shares. Conversely, if delta decreases from 0.5 to 0.4 when the stock price decreases, the number of short stocks needed to hedge would be adjusted to only 0.4 shares. This frequent rebalancing in order to maintain a targeted delta exposure as stock prices move is known as **dynamic delta hedging**.

Notice in Figure 2 that profits occur when there are larger moves in the underlying stock generated by the positive gamma or the convexity of the relationship between the convertible bond and underlying stock. In this example, there is a profit of $5 when the stock moves up or down $60. In order for the arbitrageur to profit, the strategy must make more money on gamma than what is lost by theta (negative change in price due to time passing).

Price changes determine the relationship between realized and implied volatility. **Realized volatility** refers to the actual observed volatility or standard deviation of the underlying

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stock. **Implied volatility** of an option or embedded option refers to the standard deviation of returns based on the observed market option price. The key to traditional convertible bond arbitrage is to buy convertible bonds with underpriced conversion options (implied volatility is too low), short sell convertible bonds with overpriced conversion options (implied volatility is too high), and maintain hedges with offsetting positions in the underlying equity to control for market risk.

Short Selling Strategy

Short selling large amounts of the underlying common stock is the most common convertible arbitrage strategy. In order to short sell an asset, an investor must borrow the asset from a broker or investment bank. The borrower of the short position posts collateral equal to the price of the stock and a margin of 2%, sometimes referred to as a *haircut*. The lender of the security earns the interest on the collateral but often offers a rebate. A **rebate** is the payment of interest to the security's borrower on the value of the collateral posted.

Popular target firms for short sellers create special risks. In addition, the stocks of these firms become difficult to borrow. A **special stock** is a high demand stock, which requires higher net fees in order to borrow. Thus, the short seller would receive a smaller rebate when borrowing these stocks. In contrast, a **general collateral stock** refers to stocks that have not experienced a spike in demand. Therefore, the short seller would receive the full rebate on general collateral stocks. A **short squeeze** occurs when holders of a short position are forced to purchase shares at increasing prices to cover their position due to limited liquidity. Upward price pressure on the underlying security occurs when several hedge fund managers are forced to cover short positions.

Complexity of Convertible Bond Arbitrage

Convertible bonds are a small and complex asset class that may offer liquidity and/or complexity premiums. Convertible bonds may be mispriced due to their complexity, allowing skilled managers to identify and profit from information asymmetries. A **complexity premium** is an excess return that compensates the investor for analyzing and managing a position that requires time and expertise. Convertible bonds are already complex, but, at times, they become even more difficult to analyze when they involve call or put options, dual currencies, or forced conversions. In addition, hedge fund managers may hedge interest or credit risk using interest rate or credit derivatives.

Reasons for Underpricing Convertible Bonds

Convertible bond strategies earned excess returns for the last 20 years, and it appears that this may continue for the foreseeable future. There are four reasons issuers may continue to offer convertible bonds at attractive prices:

1. *Agents may underestimate the true costs of issuing convertible bonds.* Issuers may be attracted to the lower costs of debt for convertible bonds and may not be cognizant of the effects of dilution. **Dilution** occurs when new equity is issued below market values. Dilution decreases the equity value for existing shareholders.

2. *Agents of small firms may not have any other options than to issue convertible bonds.* Most convertible bonds cannot be sold in a public market and trade only among institutional investors. As a result, they have less liquidity and require liquidity risk premiums.

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3. *Potential conflict of interest between straight bond investors and shareholders regarding the volatility of corporate assets.* Straight bondholders prefer low asset volatility to keep the probability of bankruptcy low. Shareholders prefer high asset volatility, as their positions resemble call options on the firm's assets. Convertible bonds help bridge this conflict because their valuations are sensitive to both equity and debt risk factors.

4. *Indirect equity issuance costs.* Convertible bonds are used as an indirect way to issue equity to avoid the high costs of directly issuing new equity. Issuing new stock may signal to the market that the current stock price is overvalued.

Components of Convertible Arbitrage Returns

The total return of a convertible arbitrage strategy comes from the following components:

- Income component = coupon payments made by the convertible bond – stock dividends on the underlying stock + short stock rebate – any financing costs
- Capital gains/losses on stock and convertible bond trading = difference between appreciation/depreciation in the price of the bond and appreciation/depreciation in the value of the short stock position

The total return to convertible arbitrage strategies is summarized in Figure 3. The return factors on the left side of Figure 3 are related to the income component, and the return factors on the right side are related to the capital gains and losses of the underlying stock and convertible bond.

Figure 3: Total Return to Convertible Arbitrage Strategies

Arbitrage Income	*Capital Gains and Losses*
+ bond interest	+ capital gains on stock and bond
– stock dividends	– capital losses on stock and bond
+ short stock rebate	
– financing expense	
total strategy return = arbitrage income + capital gains	

Convertible Bond Arbitrage: Risk and Return

The mispricing of convertible bonds can occur with even small differences in the volatility used to price the embedded stock option in a convertible bond. For example, a difference of 2% in the volatility can misprice the bond by 1%. Convertible bond arbitrageurs often apply leverage to increase expected returns and compensate for the mispricing of convertible bonds. However, applying leverage is now more difficult to accomplish than it has been in the past. Unprecedented mispricing occurred during the financial crisis of 2007–2008, and leverage magnified gains and losses. As a result, the majority of convertible arbitrage strategies now use either no leverage or a limited amount of leverage. Lender limits have caused a 4:1 leverage ratio to become the standard industry maximum.

The risks of convertible bond arbitrage are summarized as follows:

- *Interest rate risk.* Convertible bonds are exposed to changes in the risk-free interest rate, which causes bond prices to fall when rates rise.
- *Equity and volatility risks.* A short equity position is used to hedge the equity risk of the convertible bond. Long positions in vega and gamma embedded in the convertible bond can increase profits when volatility increases. Theta measures the loss of value as time passes.

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- *Correlation risk*. The strategy uses long correlation so if interest rates rise, bond losses are offset by gains in the short equity position. With low correlation, bonds and stocks move in opposite directions with the potential for losses from both components.
- *Credit risk*. Bond prices fall when credit spreads widen.
- *Legal risk*. Regulatory rulings limiting the use of leverage, short selling, and accounting changes can significantly reduce the return potential of convertible bond arbitrage.
- *Liquidity and crisis risks*. Liquidity risks for convertible bond arbitrageurs increase due to equity short squeezes, widening bid-ask spreads of convertible bonds, and increases in borrowing rates.

Performance of Convertible Arbitrage Funds

The historical cross-sectional performance of convertible arbitrage funds can be proxied using the HFR Fixed-Income Convertible Arbitrage Index from 2000–2014. The convertible arbitrage strategy had a modest Sharpe ratio that underperformed global bonds but outperformed world equities and commodities. Convertible arbitrage had returns and volatility between global bonds and U.S. high-yield bonds. The return distribution had negative skewness and leptokurtosis. Importantly, the convertible arbitrage exhibited positive downside correlation with equities during periods of market turmoil, such as the 2007–2008 financial crisis, limiting its diversification potential.

In addition, the convertible arbitrage strategy underperformed relative to the more general HFR Relative Value Index. While both indices had similar returns, skewness, and kurtosis, the convertible arbitrage index had a considerably higher standard deviation, resulting in a substantially lower Sharpe ratio. The largest overall negative skews and fat tails were associated with both relative value indices, supporting the notion that relative value arbitrage strategies are similar to writing out-of-the-money options. High correlations for the convertible bond arbitrage and relative value indices with traditional asset classes indicate modest diversification benefits for an otherwise diversified portfolio.

Volatility Arbitrage

LO 19.3: Demonstrate knowledge of volatility arbitrage.

For example:

- **Define and describe the concepts of vega and anticipated volatility.**
- **Recognize instruments used by volatility arbitrage funds.**
- **Identify and apply the approach for determining the final payoff of a variance swap and a volatility swap.**
- **Compare the risks of exchange-traded derivatives and over-the-counter (OTC) derivatives.**
- **Recognize the types of volatility arbitrage strategies.**
- **Discuss the characteristics of market-neutral volatility funds.**
- **Recognize the challenges of estimating and forecasting dispersion.**
- **Discuss the characteristics of tail risk strategies and how their performance depends on correlation among assets.**
- **Discuss the characteristics of dispersion trades.**
- **Recognize inferences that can be drawn from comparing definable characteristics of volatility arbitrage funds with their historical stand-alone and portfolio performance.**

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Volatility arbitrage strategies attempt to capitalize on differences in the implied volatility that exist between option prices on a particular stock. Volatility is a primary component of option pricing models. By starting with the market price of an option and working backward through an option-pricing model, the hedge fund manager can determine the option's *implied volatility*.

Volatility arbitrage funds use any instrument with volatility exposure [e.g., exchange-traded options, warrants, convertible bonds, over-the-counter (OTC) options, and OTC swaps]. In addition, assets without option-like characteristics are often held by these funds to hedge positions.

Vega and Anticipated Volatility

Vega measures the risk of a change in the volatility of a price or rate that is a value determinant of the position or asset. Vega is the first derivative of the option price with respect to the implied volatility of the underlying asset in the option. A change in the volatility of prices or rates that result in economic dispersion is known as **vega risk**.

Anticipated volatility is the future level of expected volatility for a market participant. The manager bases anticipated volatility on historical volatility observations. The manager compares the anticipated volatility to implied volatility. The manager takes a *long option position* when anticipated volatility exceeds implied volatility and a *short option position* when anticipated volatility is less than implied volatility.

Variance and Volatility Swap Payoffs

Variance swaps are forward contracts based on the variance of a price or rate. The variance swap buyer agrees to pay the variance seller a cash price (known as the swap strike price or strike variance) in exchange for receiving realized variance. The contract's **vega notional value** scales the size of the cash flows and is commonly set at $100,000. The difference between the realized variance and the strike variance is multiplied by the **variance notional value** to determine the amount of the cash payment. The variance notional value is similar to the vega notional value and is calculated as follows:

$$\text{variance notional value} = \frac{\text{vega notional value}}{2 \times \sqrt{\text{strike variance}}}$$

The formula for determining the variance swap payoff at maturity is:

$$\text{variance swap payoff} = \frac{\text{vega notional value} \times (\text{realized variance} - \text{strike variance})}{2 \times \sqrt{\text{strike variance}}}$$

Provided on Exam

If the variance notional value is given, we can use the simplified equation below:

$$\text{variance swap payoff} = \text{variance notional value} \times (\text{realized variance} - \text{strike variance})$$

Volatility swaps are similar to variance swaps, but they use volatility rather than variance. They are considerably less numerous than variance swaps since the pricing of variance swaps is considerably easier.

volatility swap payoff = vega notional value × (realized volatility – strike volatility)

Example: Calculating payoff of a variance swap

Suppose two parties enter into a 30-day variance swap agreement on the returns of the S&P 500 Index with a vega notional value of $100,000. The annual variance is 6%, and the corresponding strike variance is 6.0. Suppose that after 30-days the realized variance of the S&P 500 Index is 5.5. What is the cash payoff at maturity?

Answer:

$$\text{payoff} = \frac{\$100{,}000 \times (5.5 - 6.0)}{2 \times \sqrt{6}} = -\$10{,}206$$

If the variance notional value is given as $20,412, then we can calculate the payoff as follows:

payoff = $20,412 × (5.5 – 6.0) = –$10,206

Risks of Exchange-Traded and OTC Derivatives

Exchange-traded derivatives are less risky than over-the-counter (OTC) derivatives because exchange-traded derivatives typically have:

- *Less counterparty risk.* **Counterparty risk** is the risk of one side of a contract not being able to fulfill its obligation. Exchange-traded derivatives have clearinghouses with the capital, incentives, and power to demand collateral and creditworthiness of market participants.
- *Higher price transparency and less pricing risk.* Price transparency pertains to market participant buy and sell information regarding security prices and position sizes. **Pricing risk** is the potential mispricing of positions. Exchange-traded derivatives have observable prices with bid-ask spreads, whereas OTC derivatives may not have price information due to their unique nature.
- *Higher liquidity.* Exchange-traded derivatives have standardized terms that result in higher liquidity than OTC derivatives. The price transparency of exchange-traded derivatives also makes marking-to-market easier. **Marking-to-market** is the process of using current market prices to value instruments, positions, or portfolios. OTC derivatives require **marking-to-model**. Thus, complex models are required to estimate current values of positions using OTC derivatives.

Types of Volatility Arbitrage Strategies

Volatility arbitrage trading strategies willingly incur **correlation risk** and **volatility risk** to generate returns. The two main types of volatility arbitrage funds are:

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1. *Long volatility funds*. A buyer in the variance swap previously discussed in this topic review is an example of a long volatility arbitrage strategy. Long volatility funds are used to provide tail risk protection in times of rising volatility.

2. *Market-neutral volatility funds*. Market volatility neutral funds attempt to earn profits without exposure to market volatility. For example, an arbitrageur uses offsetting positions in two options with different implied volatilities in the same or similar underlying asset. In theory, two options on the same underlying stock should have the same volatility. If a manager finds that the implied volatilities of two options on the same stock are different, the manager uses the historical volatility of the stock to determine the potential for mispricing of the two options. The manager then purchases the underpriced option (i.e., the option with lower implied volatility) and short sells the overpriced option (i.e., the option with higher implied volatility) with the expectation that the implied volatilities of each option will revert to their historical average and the prices of the two options will converge.

Tail Risk Strategies

Tail risk refers to the probability of a large loss due to the occurrence of an unusual event. **Portfolio insurance** refers to investment strategies designed to limit a portfolio's tail risk. Often portfolio insurance relies on holding market options that are deep out-of-the-money but would become profitable as a result of an extreme market event. Unfortunately, these put options expire out-of-the-money in normal market conditions and, therefore, typically generate losses for the portfolio.

Tail risk strategies involve market protection from large losses without the purchase of put options. For example, some volatility arbitrage strategies are designed to earn large profits if a market crisis or large losses in traditional assets occur, while incurring only small losses under normal market conditions. The challenge to tail risk strategies is providing protection to severe market downturns without incurring excessively high costs in normal markets.

Correlations go to one is the notion that during down market conditions or a market crisis, assets that are normally uncorrelated have correlations that approach one. This occurs because the market factor dominates the idiosyncratic (i.e., asset-specific) factors during times of market stress. Thus, tail risk pay-off strategies are designed to be negatively correlated with traditional assets and market indices.

Dispersion Trading

There are two major challenges related to the estimation of dispersion in the context of volatility derivatives:

1. Consistent methodologies should be used to estimate and compare implied versus realized volatility.

2. There is a linear relationship between the payoff of variance swaps and the square of volatility (or variance). Thus, there is a non-linear relationship between the payoff and the standard deviation.

Dispersion trades speculate on correlations between assets. Correlation is a key factor in determining the portfolio's variance when individual assets are combined. Combining assets with lower correlations lowers the total portfolio risk. Because individual assets are not highly correlated, the realized variance of individual assets tends to be higher than the

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realized variance of a related index. The implied variance of options on individual assets tends to be higher than the implied variance of options on a related index.

The **classic dispersion trade** (or **short correlation trade**) takes a long position in options of individual equities and a short position in a related index option such that the combined positions are market neutral. For example, a hedge fund may have a long position in options on 50 large capitalized equities and a short position in the S&P 500. The classic dispersion trade is built on the assumption that realized correlations will be lower than implied correlations of index options. In a short correlation trade, profits are associated with low levels of realized correlations and losses are associated with high levels of realized correlations.

Performance of Volatility Arbitrage Funds

The historical cross-sectional performance of volatility arbitrage funds can be proxied using the HFR Relative Value: Volatility Index from 2005–2014. The cross-sectional average returns of volatility funds were low with modest volatility, resulting in modest Sharpe ratios. The return distribution had negative skewness and leptokurtosis. Volatility funds also had a low correlation with world equities and global bonds. Importantly, volatility funds had low correlation with traditional assets during extreme market events, suggesting moderate diversification benefits.

Fixed-Income Arbitrage

LO 19.4: Demonstrate knowledge of fixed-income arbitrage.

For example:

- **Discuss duration neutrality, leverage, and liquidity in the context of fixed-income arbitrage.**
- **Recognize types and characteristics of fixed-income arbitrage strategies.**
- **Discuss the risks and returns of sovereign debt in fixed-income arbitrage strategies, and apply the concept of modified duration to bond returns and volatility.**
- **Recognize the characteristics of asset-backed and mortgage-backed securities strategies.**
- **Discuss and determine the effects of prepayment risk and option-adjusted spreads on asset-backed and mortgage-backed securities strategies.**
- **Analyze the risks of asset-backed and mortgage-backed securities arbitrage.**
- **Recognize inferences that can be drawn from comparing definable characteristics of fixed-income arbitrage with its historical stand-alone and portfolio performance.**

Fixed-income arbitrage strategies combine the purchase of one fixed-income security with the simultaneous sale of a similar fixed-income security. The manager hopes to profit from small pricing discrepancies between the two bonds as the spread between their prices converges over time.

Because pricing discrepancies are generally small, the manager typically uses significant leverage in order to generate meaningful returns. Leverage allows the opportunity for substantial positive returns when prices converge to normal. High levels of leverage can increase the risk of the strategy and lead to large losses in crisis markets.

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Fixed-income arbitrage funds focus on managing liquidity and adjusting the position size as mispricings between fixed-income securities occur. The fund manager hedges the position against market factors, such as credit risks and interest rate risks, and waits for the market to converge as the undervalued security increases in price and the overvalued security decreases in price.

Fixed-Income Arbitrage Terminology

Duration measures the sensitivity of a security to a change in interest rates. **Modified duration** is used when the yield given is something other than a continuously compounded rate and incorporates the number of compounding periods in a given year. Note that as the number of compounding periods goes to infinity (continuous compounding), there is no difference between the two measures. A **duration-neutral** position suggests the returns of the hedge are relatively insensitive to changes in the general level of market interest rates. A duration-neutral strategy creates a portfolio where the aggregated duration of the short positions has an equal value weight to the aggregated duration of the long positions. Because both duration and modified duration are based on the expected cash flows for an option-free bond, they are not an appropriate estimate of the price sensitivity of bonds with embedded options.

Example: Duration-neutral strategy

A hedge fund purchases a $5,000 bond that matures in 6 years and has a duration of 4.0. **Determine** the size of the short position that would be needed for the hedge fund to achieve a duration-neutral position. Assume zero-coupon bonds with a maturity of 6 years will be used for the short position.

Answer:

Long position size: $5,000
Long position duration: 4.0
Short position duration: 6.0 (Duration is equal to maturity for zero-coupon bonds.)

Short position size = $5,000 × (4.0 / 6.0) = $3,333

Fixed-Income Arbitrage Strategies

Fixed-income arbitrage strategies rely on a mispricing between two securities that is expected to correct itself as the prices of the two securities converge to their par values at maturity. Two terms need to be defined when discussing fixed-income arbitrage strategies. A **yield curve** is the relationship between the yields and maturities of various securities. The **term structure of interest rates** refers to the yield curve for zero-coupon bonds. Although many forms of fixed-income arbitrage exist, the two most common forms are spread trades and yield curve trades:

1. **Spread trades** involve two fixed-income securities with identical maturities where one security is mispriced relative to the other. These are referred to as **intercurve arbitrage positions** because the arbitrage uses different yield curves. One example of a spread trade is a **carry trade**, where a short position is taken in a low-yield asset and a long position is taken in a high-yield asset.

2. **Yield curve trades** involve trading bonds with different maturities in order to profit from changes in the slope of the yield curve. Strategies speculate the yield curve will flatten, become more steeply sloped, or become more or less curved. These are referred to as **intracurve arbitrage positions** because they are based on the same curve.

Sovereign Debt in Fixed-Income Arbitrage

Debt issued by national governments is referred to as **sovereign debt**. The risks of sovereign debt are different from corporate debt because default can only occur if the government chooses to default despite being capable of paying the debt by printing additional currency. Fixed-income arbitrage strategies can involve buying and selling U.S. Treasury securities.

For example, assume a hedge fund manager has found two U.S. Treasury bonds that each have a two-year maturity. The first bond is a two-year, on-the-run issue that was just issued. The second bond is an off-the-run issue issued eight years ago but has exactly two years remaining until maturity. Figure 4 shows the data for both bonds.

Figure 4: Comparison of Two U.S. Treasury Bonds

	Bond 1 (On-the-Run Issue)	*Bond 2 (Off-the-Run Issue)*
Time until maturity	2 years	2 years
Par value	$100,000	$100,000
Yield to maturity	4.35%	4.37%

Even though the bonds are essentially identical, the off-the-run issue has less liquidity than the on-the-run issue, and, as a result, it has a lower price and a higher yield. In order to capitalize on the pricing discrepancy, the hedge fund manager will simultaneously take a long position in Bond 2 and a short position in Bond 1. When both bonds mature in two years, their prices will converge to their par value, and the hedge fund manager will have captured the 2 basis-point difference in return.

Fixed-income arbitrage can also trade different maturity ranges when temporary imbalances in the supply and demand of securities occur. For example, suppose the two-year yield is 4.00%, the three-year yield is 4.25%, the four-year yield is 4.50%, and the five-year yield is 4.25%. An arbitrage trade would be to buy a four-year Treasury note and short sell a five-year Treasury note. If the shape of the yield curve remains unchanged after one year, the four-year bond will age into a lower yielding part of the curve, and its price will rise. Meanwhile, the five-year bond will age into a higher yielding part of the curve, and its price will fall.

The risk in this trade is that the yield curve may shift or change shape. The kink in the yield curve that the manager is attempting to exploit could disappear, reducing profitability. Also, because the hedge fund manager is trading bonds with different maturities and duration, shifts up or down in the yield curve will impact the profitability of the trade.

Riding the yield curve refers to the changes in relative rates and expected profits that are experienced while an investor holds a bond. The process of decreasing yields to maturity as an asset matures in an upward sloping yield curve environment is referred to as **rolling down**. Thus, if investors hold bonds, their returns may be driven by the shape of the yield curve and not just shifts in the yield curve.

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A duration-neutral position is protected against shifts in the yield curve, but it does not necessarily provide perfect interest rate immunization. **Interest rate immunization** eliminates all interest rate risk. A duration-neutral position, such as that calculated in the previous example, is protected from a **parallel shift** in the yield curve that occurs when all maturities shift up or down in equal amounts. A hedge fund manager needs to adjust positions to protect from a non-parallel shift and large changes in interest rates.

Asset-Backed Securities and Mortgage-Backed Securities Strategies

Asset-backed securities (ABS) are securitized instruments created from pools of underlying loans or other assets. The process of creating ABS involves taking assets that are not easily traded and converting them into assets that are more easily traded. For example, banks originate mortgage loans and then sell these loans to the financial markets by pooling the loans together.

The cash flows from ABS are difficult to predict due to prepayment rates and default probabilities. Thus, the complexity of valuing ABS makes them a good candidate for arbitrage strategies. The largest ABS type, mortgage-backed securities, had a market value of $6.1 trillion in U.S. government agency securities and $2.9 trillion in non-agency securities following the 2007–2008 crisis. The non-mortgage ABS market (e.g., credit card debt, auto loans, and student loans) contains $2.5 trillion worth of securities.

If securities have embedded options that alter the interest rate risk, then effective duration is used to measure interest rate risk. **Effective duration** measures the interest rate risk of a position that includes the effects of embedded option characteristics, such as borrowers who have the option to prepay early. Thus, for mortgage-backed securities (MBS), effective duration is used to measure the risk of early prepayment.

If a hedge fund manager models prepayment rates that are too fast, then the MBS will most likely be overvalued as the longevity of the security is underestimated. Typically, prepayment rates increase as interest rates drop and borrowers refinance. This benefits borrowers by reducing their mortgage interest but decreases the value of MBSs that reinvest at lower market rates.

MBS arbitrage strategies identify mispricing between MBS and other fixed-income securities to generate low-risk profits. For example, an arbitrageur may buy MBS and sell Treasury securities. Arbitrageurs develop complex models that include prepayment options and the **option-adjusted spread** (OAS). The OAS is the excess yield of fixed-income securities with embedded options relative to the yield of similar securities with no embedded option.

Risks of Fixed-Income Arbitrage

The primary risks of fixed-income arbitrage include interest rate risk, prepayment risk, credit spread risk, volatility risk, and liquidity risk. Duration measures *interest rate risk*. Duration declines when interest rates fall and lengthens when interest rates increase. *Prepayment risk* has similar concerns regarding changes in interest rates as borrowers refinance existing loans when rates fall.

Professor's Note: In the above paragraph, we make the assumption that refinancing burnout has not occurred.

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Credit risk spreads are guaranteed for MBS by some agencies. However, investors in ABS bear the credit risk for pools of student loans, auto loans, and credit cards. ABS have embedded short call options. With rising *interest rate volatility*, the convexity of the price-yield curve can become negative for premium or par bonds with embedded securities. During a market crisis, investors may shift to higher quality and lower risk assets (i.e., a flight-to-quality), causing the *liquidity* of riskier ABS and MBS to decline dramatically.

Performance of Fixed-Income Arbitrage

The historical cross-sectional performance of fixed-income arbitrage funds can be proxied using the HFR Relative Value: Fixed Income–Corporate Index from 2000–2014. The index indicates that fixed-income arbitrage funds had moderate average returns with modest volatility, resulting in moderate Sharpe ratios. The return distribution of fixed-income arbitrage had substantial negative skewness and substantial leptokurtosis. The maximum drawdowns were moderate for fixed-income arbitrage, and the strategy experienced substantial negative returns during the 2007–2008 financial crisis. Historical correlations of fixed-income arbitrage funds with world equities and U.S. high-yield bonds were high, including during extreme market events, suggesting only modest diversification benefits for an otherwise well-diversified portfolio. However, fixed-income arbitrage did have low correlation with global bonds, and negative correlations with credit spread changes and equity market volatility changes.

Relative Value Multistrategy Funds

LO 19.5: Demonstrate knowledge of relative value multistrategy funds.

For example:

- **Describe key characteristics of relative value multistrategy funds, and recognize inferences that can be drawn from comparing definable characteristics of relative value multistrategy with their historical stand-alone and portfolio performance.**

Relative value multistrategy funds contain a combination of multiple arbitrage strategies that have already been discussed in this topic review. Relative value multistrategies are formed to increase fund capacity, increase diversification, and increase opportunities for investment due to the cyclical nature of markets. For example, corporate bond arbitrage and ABS arbitrage may be more advantageous during different market cycles. Investors looking to achieve low-cost diversification in the relative value sector should consider purchasing a multistrategy fund.

Performance of Multistrategy Funds

The historical cross-sectional performance of relative value multistrategy funds can be proxied using the HFR Relative Value: Multi-Strategy Index from 2005–2014. The index indicates that multistrategy funds had higher returns and lower volatility compared to global bonds. However, the return distribution of multistrategy funds had negative skewness and excess kurtosis. Historical correlations of multistrategy funds with global equities and high-yield bonds were high. In addition, the strategy had low positive correlation with global bonds and negative correlations with credit spreads and equity market volatility.

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Key Concepts

LO 19.1

Relative value strategies attempt to predict changes in spreads between related prices or rates. Relative value strategies establish hedged positions with a long position on one security and a short position on a related security. Therefore, the strategy has very little market risk and tends to profit during normal market conditions when valuations converge to their equilibrium prices.

The **classic relative value strategy trade** identifies abnormal spreads between two related prices or rates and establishes a position that anticipates the convergence to normal levels.

LO 19.2

The **classic convertible bond arbitrage trade** involves the purchase of a company's convertible bonds with the simultaneous short sale of the company's common stock.

- A **busted convertible** is a bond with a very high conversion premium indicating the embedded stock options are far out-of-the-money. **Hybrid convertibles** are convertible bonds with moderately sized conversion ratios and stock options that are close to being in-the-money. **Equity-like convertible** bonds are in-the-money.
- **Delta** is the change in value of an option with respect to a change in the value of the underlying asset. **Gamma** is the second derivative of an option's price with respect to the underlying price of the asset. **Theta** is the first derivative of an option price with respect to the time to expiration for the option. Profits occur when larger moves in the underlying stock are generated by the positive gamma or the convexity of the relationship between the convertible bond and underlying stock.
- The key to traditional convertible bond arbitrage is to buy (sell) convertible bonds where the implied volatility is too low (high) and maintain hedges with the underlying equity.
- A **short squeeze** occurs when holders of a short position are forced to purchase shares at increasing prices to cover their position due to limited liquidity.
- A **complexity premium** is an excess return that compensates the investor for analyzing and managing a position that requires expertise and time.
- Four reasons issuers offer convertible bonds at attractive prices are:
  1. Agents may underestimate the true costs of issuing convertible bonds.
  2. Agents of small firms may not have any other options than to issue convertible bonds.
  3. The potential for substantial conflict of interest between straight bond investors and shareholders regarding the volatility of corporate assets.
  4. Indirect equity issuance costs.
- The total return of a convertible arbitrage strategy comes from the income component and gain or loss on stock and convertible bond trading. The risks of convertible bond arbitrage are interest rate risk, equity risk, volatility risk, correlation risk, credit risk, legal risk, liquidity risk, and crisis risk.
- The cross-sectional average return of convertible arbitrage had a modest Sharpe ratio and high correlations to traditional asset classes. The return distribution had negative skewness and leptokurtosis.

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LO 19.3

Volatility arbitrage strategies attempt to capitalize on differences in the implied volatility that exists between option prices on a particular stock.

- **Vega** is the first derivative of the option price with respect to the implied volatility of the underlying asset in the option. The manager takes a long (short) option position when the anticipated volatility exceeds (is less than) implied volatility.
- Volatility arbitrage funds use any instrument with volatility exposure [e.g., exchange-traded options, warrants, convertible bonds, over-the-counter (OTC) options, and OTC swaps].
- In a **variance swap**, the variance buyer agrees to pay the variance seller a cash price (known as the swap strike price or strike variance) in exchange for receiving realized variance.
- Two formulas for determining the variance swap payoff at maturity are:

$$\text{variance swap payoff} = \frac{\text{vega notional value} \times (\text{realized variance} - \text{strike variance})}{2 \times \sqrt{\text{strike variance}}}$$

$$\text{variance swap payoff} = \text{variance notional value} \times (\text{realized variance} - \text{strike variance})$$

- Exchange-traded derivatives are less risky than OTC derivatives because they have:
  - Less counterparty risk.
  - Higher price transparency and less pricing risk.
  - Higher liquidity.
- The two main types of volatility arbitrage funds are market volatility neutral and long volatility.
- Market-neutral volatility fund managers look for different implied volatilities of two options on the same stock. The manager then purchases the underpriced option with lower implied volatility and short sells the overpriced option with higher implied volatility and waits for the prices of the two options to converge.
- Challenges related to estimating dispersion in the context of volatility derivatives result from methodologies used to estimate and compare implied versus realized volatility and the non-linear relationship that exists between the payoff and the standard deviation.
- **Tail risk** refers to the probability of a large loss due to an unusual event. **Correlations go to one** is the notion that during down market conditions or a market crisis, assets that are normally uncorrelated have correlations that approach one.
- The **classic dispersion trade** takes a long position in options of individual equities and a short position in a related index option. In this short correlation trade, profits are associated with low levels of realized correlations and losses are associated with high levels of realized correlations.
- The cross-sectional average returns of volatility arbitrage funds were low with modest volatility resulting in modest Sharpe ratios. The return distribution had negative skewness and leptokurtosis. Volatility funds had a low correlation to world equities and global bonds, suggesting moderate diversification benefits but poor relative returns.

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LO 19.4

In a **fixed-income arbitrage strategy**, a manager buys one fixed-income security and sells a similar fixed-income security in an attempt to profit as the spread between their prices converges over time.

- A **duration-neutral** strategy creates a portfolio where the aggregated durations of the short positions have an equal value weight to the aggregated durations of the long position. Leverage allows the opportunity for substantial positive returns when prices converge to normal. Fixed-income arbitrage funds focus on managing liquidity and adjusting the position size as mispricings between fixed-income securities occur.
- Spread trades (**intercurve arbitrage positions**) involve two fixed-income securities with identical maturities where one security is mispriced relative to the other. Yield curve trades (**intracurve arbitrage positions**) involve trading bonds with different maturities in order to profit by speculating the yield curve will flatten, become more steeply sloped, or more or less curved.
- The risks of sovereign debt are different from corporate debt because default can only occur if the government chooses to default despite being capable of paying the debt.
- The process of decreasing yields to maturity as an asset matures in an upward-sloping yield curve environment is referred to as **rolling down**.
- A duration-neutral position is protected against shifts in the yield curve, but it does not necessarily provide perfect **interest rate immunization**. A hedge fund manager needs to adjust positions to protect from a non-parallel shift and large changes in interest rates.
- **Asset-backed securities** (ABS) are good candidates for arbitrage strategies due to their complex prepayment rates and default probabilities.
- **Mortgage-backed securities** (MBS) use effective duration to measure the risk of early prepayment. The **option-adjusted spread** (OAS) is the excess yield of fixed-income securities with embedded options relative to the yield of similar securities with no embedded option.
- The primary risks of fixed-income arbitrage include interest rate risk, prepayment risk, credit spread risk, volatility risk, and liquidity risk.
- Fixed-income arbitrage funds had moderate cross-sectional average returns with modest volatility, resulting in moderate Sharpe ratios. The return distribution of fixed-income arbitrage had negative skewness and leptokurtosis. Historical correlations of fixed-income arbitrage funds with world equities and U.S. high-yield bonds were high, suggesting only modest diversification benefits.

LO 19.5

Relative value multistrategy funds contain a combination of multiple arbitrage strategies. They are formed to increase fund capacity, increase diversification, and increase opportunities for investment due to the cyclical nature of markets.

The cross-sectional performance of relative value multistrategy funds indicated higher returns and lower volatility compared to global bonds. The return distribution of multistrategy funds had negative skewness and excess kurtosis. Also, correlations of multistrategy funds with global equities and high-yield bonds were high.

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Concept Checkers

1. Which of the following statements is **INCORRECT** regarding relative value strategies? Relative value strategies:
   A. have very little market risk.
   B. focus on large price and rate movements, so managers utilize leverage to hedge the fund's returns.
   C. tend to profit during normal market conditions when valuations converge to their equilibrium prices.
   D. establish hedged positions with a long position on one security and a short position on a related security.

2. A convertible bond that has a very high conversion premium is known as:
   A. a busted convertible.
   B. a hybrid convertible.
   C. an equity-like convertible.
   D. a delta-neutral convertible.

3. Suppose two parties enter into a 30-day variance swap agreement on the returns of the S&P 500 Index with a vega notional value of $100,000. The strike variance is 5.0. Suppose that after 30 days the realized variance of the S&P 500 Index is 5.5. What is the cash payoff at maturity?
   A. –$22,361.
   B. $10,000.
   C. $11,180.
   D. $22,361.

4. With regard to Treasury notes, suppose the three-year yield is 5.25%, the four-year yield is 5.50%, and the five-year yield is 5.25%. A fixed-income arbitrageur with a one-year time horizon would *most likely* buy a:
   A. four-year Treasury note and short sell a five-year Treasury note.
   B. five-year Treasury note and short sell a four-year Treasury note.
   C. four-year corporate bond and short sell a four-year Treasury note.
   D. five-year Treasury note and short sell a five-year corporate bond.

5. Which of the following is **NOT** a reason to create a relative value multistrategy fund?
   A. Increase investment opportunities.
   B. Take advantage of different market cycles.
   C. Decrease capacity.
   D. Increase diversification.

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Concept Checker Answers

1. **B** Relative value strategies profit during normal market conditions when valuations converge to their equilibrium prices (i.e., when prices or rates return to relative values under normal conditions). These price and rate movements are often very small, so managers use leverage to increase the fund's returns. (LO 19.1)

2. **A** A busted convertible is a bond with a very high conversion premium indicating the embedded stock options are far out-of-the-money. (LO 19.2)

3. **C**

$$\text{variance swap payoff} = \frac{\text{vega notional value} \times (\text{realized variance} - \text{strike variance})}{2 \times \sqrt{\text{strike variance}}}$$

$$\text{variance swap payoff} = \frac{100{,}000 \times (5.5 - 5.0)}{2 \times \sqrt{5.0}} = \frac{50{,}000}{4.4721} = \$11{,}180$$

(LO 19.3)

4. **A** The arbitrage trade would be to buy a four-year Treasury note and short sell a five-year Treasury note. If the shape of the yield curve remains unchanged after one year, the four-year bond will age into a lower yielding part of the curve and its price will rise. Meanwhile, the five-year bond will age into a higher yielding part of the curve, and its price will fall. (LO 19.4)

5. **C** Relative value strategies capitalize on many different forms of arbitrage. Relative value multistrategy funds are formed to increase fund capacity, increase diversification, and increase opportunities for investment due to the cyclical nature of markets. (LO 19.5)

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The following is a review of the Hedge Funds principles designed to address the learning objectives set forth by the CAIA Association®.

Equity Hedge Funds

Topic 4.5

Exam Focus

Long/short equity hedge funds expand the investment opportunity set and have higher expected returns than long-only portfolios at every level of tracking error. Fund managers have less competition in identifying securities for short positions. Candidates should be able to describe the characteristics and implementation of the long/short, market-neutral, and short-bias hedge fund strategies. Numerous market anomalies are discussed as potential sources for generating ex ante alpha. The learning objectives emphasize various sources of ex ante alphas generated by managers who provide liquidity, exploit market inefficiencies, and analyze complex securities. Candidates should understand the calculations associated with and the implications of using the fundamental law of active management to quantify the relationship between the information ratio and the skill and breadth of hedge fund managers.

Equity Hedge Fund Styles

LO 20.1: Demonstrate knowledge of sources of return for equity hedge funds.

For example:

- **Describe the general design of an equity hedge strategy.**
- **Discuss providing liquidity as a source of return for equity hedge funds.**
- **Discuss providing informational efficiency as a source of return for equity hedge funds.**
- **Discuss the process of using factor analysis to enhance returns for equity hedge funds.**

Data accumulated by Hedge Fund Research (HFR) indicate that equity hedge funds represent 37% of all hedge fund styles and 28% of total assets under management (AUM) as of the end of 2014. Thus, equity hedge funds are the most popular type of hedge fund strategy and include equity long/short funds, equity market-neutral funds, and short-bias funds.

The overall strategy of equity hedge funds is based on establishing a long position in undervalued equities and a short position in overvalued equities. The mix of long/short positions determines the amount of systematic or market risk exposure for the equity hedge fund strategy. For example, **equity long/short funds**, which invest in more long positions than short positions, have a net long market risk exposure. **Equity market-neutral funds** attempt to eliminate exposure to market risk by balancing the long and short positions of the fund equally and maintaining a portfolio beta of 0. **Short-bias funds** have a higher percentage of short positions relative to long positions with a goal of seeking profits during periods of market declines. The success of these various types of equity hedge funds depends on the manager's ability to identify overvalued equities for the short positions and undervalued equities for the long positions.

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Sources of Return

Liquidity

Some market participants may be more concerned with filling large orders in a timely basis than getting the best price in a short time period. Equity hedge funds provide **liquidity** to the market by buying large quantities of securities at small discounts from these large market orders. For example, a large investor trying to increase her position would expect the price of the stock to increase as the investor purchases a substantial amount of the stock in the market. In order to purchase the shares all at once, the investor would be willing to pay a small premium to a hedge fund holding a large portion of the desired shares.

In this example, the large investor is decreasing the supply of limit orders near the current bid-ask spread. This is referred to as **taking liquidity**. An institution that is taking liquidity reduces the current supply of available sellers in order to establish their desired long-term position. The hedge fund is providing liquidity. Thus, the act of **providing liquidity** increases the amount of shares available near the current bid and offer prices. The hedge funds are willing to step in to offer a bid or ask position that offsets the market pressure from the large orders.

Hedge funds in this sense are considered **market makers** because they provide liquidity on both sides of the transaction when needed and help balance the market. If an institution starts selling a large quantity of stocks in a short time period, the stock price will drop. One or more equity hedge funds will start acquiring the shares at depressed prices and provide liquidity to the market. Conversely, hedge fund managers will short sell shares when large institutions start acquiring large quantities of shares in short time periods.

Informational Efficiency

In addition to gaining profits by providing liquidity, equity hedge funds earn excess returns by taking advantage of informational inefficiencies that exist in the market. Traders, at times, may make irrational decisions based on behavioral factors. If markets reflect all publicly available information on a timely basis, then the markets are considered **informationally efficient**. However, equity hedge fund managers believe temporary inefficiencies exist. Their actions to capture these inefficiencies cause markets to become more efficient.

Relatively few investors are willing to take short positions in equities. Thus, there is less competition for finding overvalued stocks than there is for finding undervalued stocks. **Short interest** refers to the amount of short sales as a percentage of the total outstanding shares. Empirical evidence suggests that stocks with high levels of short interest are more likely to underperform the market. This suggests that hedge fund managers are skilled at selecting overpriced securities.

Another example of informational inefficiency is related to **asynchronous trading**. For example, one stock in an industry may react more quickly to news that should impact the entire industry. Thus, an equity hedge fund may quickly make trades on related equities whose reaction to the news is slightly delayed. Abnormal profits are earned by hedge funds when market participants **overreact** or **underreact** to new information. Hedge fund managers attempt to identify firms that historically tend to overreact or underreact to news.

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If a pattern is discovered, then the hedge fund manager establishes positions to exploit that pattern when new information related to the company arrives in the market.

Equity hedge fund managers are rewarded with a **complexity premium**. They invest in securities that are more difficult to analyze and require an additional complexity premium as a reward for performing the additional analysis.

Factor Analysis

There are a variety of different factor models that explain historical returns and are used to form expectations of future returns. Empirical studies of these models are concerned with answering two main questions. First, can historical returns explain future returns? Second, are the returns attributable to alpha or beta (market) factors? For example, Fama and French found evidence that small-company stocks consistently earn higher risk-adjusted returns than their betas imply. Abnormal returns are defined as excess returns above what is expected based on applying a market model such as the capital asset pricing model (CAPM). Hedge fund managers may **speculate** by taking on abnormal risk in exchange for abnormal returns.

Market Anomalies

LO 20.2: Demonstrate knowledge of market anomalies.

For example:
- **Discuss how market efficiency tests are tests of joint hypotheses.**
- **Identify issues involved in predicting persistence of market anomalies.**
- **Describe and apply accounting accruals as potential predictors of ex ante alpha.**
- **Define price momentum, and recognize its potential role in generating ex ante alpha.**
- **Define earnings momentum, and recognize its potential role in generating ex ante alpha.**
- **Define net stock issuance, and recognize its potential role in generating ex ante alpha.**
- **Define insider trading, and recognize its potential role in generating ex ante alpha.**

Market anomalies are investment strategies that over time consistently result in abnormal returns or higher returns than predicted by market models such as the CAPM.

Market Efficiency Tests

Any empirical investigation of market efficiency is actually a **test of joint hypotheses**. The researcher is assuming a model used in the test is a valid model to explain the market. At the same time, this assumed model is used to test whether or not a strategy is able to earn abnormal returns. However, it can never be known with certainty whether the abnormal returns are due to **model misspecification** or market inefficiencies. A return model is misspecified when important explanatory factors are omitted from the model. For example, early studies used a single-factor CAPM to test for market anomalies. Most researchers now tend to prefer a Fama-French CAPM model that adjusts for the stock's market beta, market capitalization beta, and price-to-book beta. However, this model may still be misspecified.

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Predicting Persistence of Market Anomalies

When an anomaly is identified, it raises the question of whether that result is from spurious correlations rather than the true underlying correlation. In addition, if this is a valid anomaly historically, the question remains whether the anomaly will persist in the future. Thus, it is necessary to provide an explanation for the underlying anomaly to guide the hedge fund manager in implementing the strategy. This explanation should identify the market participant earning the excess returns and the reasons that the institutions or investors on the other side of the trade are willing to make the trade.

Accounting Accruals

The accounting statements of firms are based on accrual basis rather than cash basis. An **accounting accrual** recognizes revenues and expenses based on future transactions. For example, the net income of a firm using the accrual basis reflects revenues from credit sales even though the firms did not receive the cash from the sales. The financial managers of firms have an incentive to manipulate earnings to meet the market's expectations. If a manager inflates current earnings using accounting accruals, then future earnings should be negatively impacted because future profits were already recognized. Similarly, if current expenses are deferred to future periods, then current earnings are exaggerated and future earnings will suffer.

The accounting definition of total accruals is as follows:

$$\text{total accruals} = \Delta CA - \Delta CL - \Delta cash + \Delta STDEBT - D\&A$$

Provided on Exam

where:

ΔCA	= change in current assets
ΔCL	= change in current liabilities
$\Delta cash$	= change in cash
$\Delta STDEBT$	= change in short-term debt
D&A	= depreciation and amortization expenses

Using this framework, an increase in noncash current assets (i.e., $\Delta CA - \Delta cash$) suggests a buildup of accounts receivable and/or inventory. This buildup may fail to result in future profits if customers do not buy the inventory because it is obsolete or if customers default on the accounts receivable. Current liabilities and short-term debt can include deferred tax liabilities or deferred accounts payable that will increase current earnings and defer current expenses to a future period. A decrease in noncash expenses, such as depreciation and amortization expenses, will increase current earnings but reduce free cash flow.

Recognizing the incentives of firms to meet market expectations, Bradshaw et al.[1] find that when a firm reports net income significantly higher than operating cash flows, future negative earnings surprises are more likely to occur. Thus, equity hedge fund managers buy stocks with negative accruals (higher free cash flow / net income) and sell stocks with positive accruals (lower free cash flow / net income).

[1] Mark Bradshaw, Scott Richardson, and Richard Sloan, "Do Analysts and Auditors Use Information in Accruals?" *Journal of Accounting Research* 39, no. 1, (June 2001): 45-74.

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Price Momentum

Technical analysis is also used to identify anomalies related to changes in price and volume. **Price momentum** refers to the increased likelihood of higher future prices following an upward trend in prices and lower future prices following a downward trend in prices. Thus, price momentum strategies are based on stock prices having positive serial correlation, known as positive autocorrelation.

An empirical study conducted by Chan et al.[2] ranked the performance of stocks over a six-month period and examined which stocks did better in the subsequent six-month period. The findings of the study suggest that stocks that performed well in the previous six months outperform stocks that performed poorly in the previous six months. Conversely, when the time horizon is very short or very long, a price reversal effect was found (i.e., outperformance or underperformance canceled out over time).

One rational explanation of price momentum is that large positions in stocks must be traded over a period of time. Furthermore, as a hedge fund builds a position in an undervalued firm, the market gradually learns about the increased value in the firm, and the price momentum continues even further. Small-cap stocks with less liquidity tend to exhibit more price momentum consistent with this reasoning.

Earnings Momentum

Similar to price momentum, **earnings momentum** suggests that changes in earnings are positively correlated over time. The opposite of this is an **earnings surprise** where an unexpected earnings announcement occurs. When actual earnings exceed expected earnings, it results in a positive surprise, and when actual earnings are below expectations, a negative surprise occurs. One method used to measure earnings surprises is the **standardized unexpected earnings** (SUE). Analysts may use different definitions of SUE. However, SUE is often calculated as follows:

$$\text{SUE} = \frac{\text{EPS} - \text{ACEPS}}{\text{SDEM}}$$

where:

EPS	= actual earnings per share
ACEPS	= analyst consensus average EPS estimate
SDEM	= standard deviation of earnings misses

The numerator is the difference between actual earnings and the average earnings expected. The denominator is estimated by examining the standard deviation of actual and expected EPS over the previous eight quarters. Studies suggest stock prices tend to continue to move in the direction of SUE. Positive (negative) price movements follow from a history of positive (negative) earnings surprises. A **post-earnings-announcement drift** suggests that equity hedge funds can profit by immediately buying (selling) after a positive (negative) earnings surprise. Small-cap stocks and stocks where analysts have been increasing earnings estimates are good candidates for equity hedge funds seeking to engage in this strategy.

[2] Louis Chan, Narasimhan Jegadeesh, Josef Lakonishok, "The Profitability of Momentum Strategies," *Financial Analysts Journal* (November 1999): 80–90.

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Net Stock Issuance

Findings of empirical studies suggest that positive or negative **net stock issuance** (i.e., shares issued less shares that have been bought back) is one of the most profitable anomalies for stock investors.

When a company purchases its own shares through the market or a tender offer, it is known as a **share buyback program**. The reduced shares outstanding will result in higher future EPS. In addition, this may be a signal to other investors that managers, who are more informed of the true value of the firm, believe the stock is undervalued.

When a company has an **issuance of new stock**, the exact opposite can occur. An issuance of new stock can be the result of a secondary offering or a stock-for-stock merger. Studies find that firms that issue new stock shares that total more than 20% of their outstanding shares often underperform the market after the issuance. In addition, firms acquiring other firms by issuing stock underperformed over the subsequent five-year period as a result of the issuer signal that the stock was overvalued. Thus, an equity hedge fund manager would establish long positions in firms with share buyback programs and short positions with firms issuing large amounts of new stock.

Insider Trading

There are two types of insider trading: legal and illegal. **Illegal insider trading** involves trading based on private information such as an impending merger or future earnings announcement without required disclosure. The Securities and Exchange Commission (SEC) requires senior executives to disclose their trades and make that information available to the market. Senior executives are insiders who have more knowledge of the firm than the public. Therefore, if they are buying or selling shares in the firm, this is a possible signal regarding the future performance of the firm.

An example of **legal insider trading** involves basing trades on the action of senior executives. The challenge in applying this strategy is that the motive of senior executives is unclear. Senior executives may be making the trades for personal reasons, such as exercising stock options as a form of compensation and then selling the shares to diversify their personal portfolio. Alternatively, they may be selling or buying the shares because they think the stock is mispriced.

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Fundamental Law of Active Management

LO 20.3: Demonstrate knowledge of the Fundamental Law of Active Management (FLOAM).

For example:

- **Calculate and interpret the key components (i.e., breadth and the information coefficient) of the FLOAM.**
- **Describe and determine how the FLOAM can be used to understand changes in the information ratio.**
- **Recognize trade-offs involved in changing or maintaining the information ratio.**
- **Define nonactive bets, and recognize their role in the FLOAM.**

The two key components of the **Fundamental Law of Active Management (FLOAM)** are the breadth and skill of actively managed strategies. The challenge in active management involves a tradeoff of focusing on securities with higher return opportunities and maintaining a diversified portfolio.

The number of independent active trades in an actively managed portfolio in a year is known as the **breadth** of a strategy. Trades are independent if there is a lack of statistical correlation between the positions that are obtained due to their perceived mispricing. Trades that are short-term in nature are referred to as *active trades*. The **information coefficient (IC)** measures managerial skill as the correlation between actual realized and forecasted managerial returns:

$$\text{IC} = \text{correlation (forecasted returns, actual returns)}$$

Either a Pearson correlation coefficient or the Spearman rank correlation coefficient is used to estimate the ability of the manager to forecast abnormal returns. Recall that the Spearman rank correlation coefficient compares the rank of the expected returns to the rank of the realized returns.

FLOAM and the Information Ratio

The FLOAM process links the breadth (i.e., number of active trades or bets per year) and skill (i.e., IC) of the manager to the information ratio (IR) as follows:

$$\text{IR} = \text{IC} \times \sqrt{\text{breadth}}$$

Note that the IR is positively related to the breadth measured as the number of securities in the portfolio. The IR is also positively related to the skill of the manager measured by the IC.

The FLOAM is used to analyze the changes in IR when there is a change in either breadth or the IC.

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Example: Calculating the information coefficient

Suppose five different portfolio managers use different equity strategies that require a different number of active bets per year. Assuming the desired information ratio is a constant 1.0, **calculate** the IC using the FLOAM relationship for the following five managers:

- Manager 1 uses an equity market timing strategy with 5 active bets per year.
- Manager 2 uses a short-bias strategy and makes 10 active bets per year.
- Manager 3 uses an equity long/short strategy and makes 25 active bets per year.
- Manager 4 uses a market-neutral strategy with 50 active bets per year.
- Manager 5 uses a long-only strategy with 100 active bets per year.

Answer:

Using the FLOAM relationship, the IC for each manager is calculated using the following equation:

$$\text{IR} = \text{IC} \times \sqrt{\text{breadth}}$$

For example, the IC for Manager 1 would be calculated as follows:

$$1 = \text{IC} \times \sqrt{5}$$
$$1 / 2.2361 = \text{IC}$$
$$\text{IC} = 0.4472$$

Figure 1 summarizes the results for taking the IR of 1 and dividing by the square root of the number of active bets to determine the IC for the five managers.

Figure 1: Manager's Tradeoff of IC and Breadth With a Fixed IR of 1

Manager	1	2	3	4	5
Breadth (bets/year)	5	10	25	50	100
Information coefficient	0.447	0.316	0.200	0.141	0.100

Figure 2 illustrates the tradeoff between the IC and breadth using the data in this example. This illustrates that when an active manager increases breadth, the IC will decrease. This relationship holds because an investment manager starts with the best ranking opportunities and, as the number of active bets increase, less attractive bets are used. This causes the IC to decrease.

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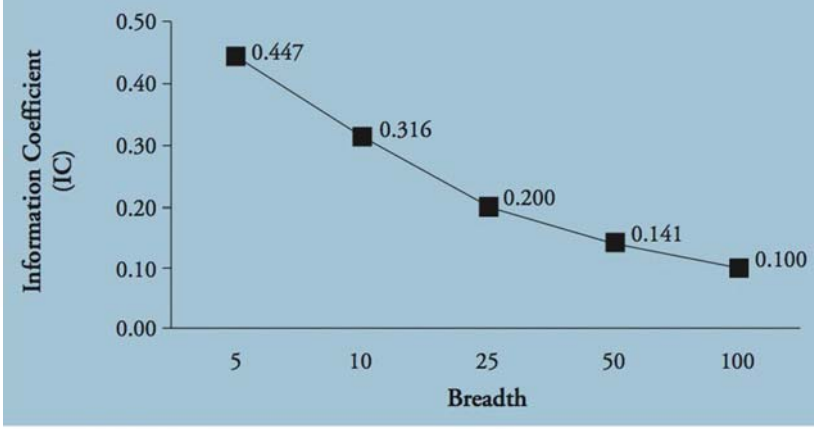
Figure 2: Manager's Tradeoff of IC and Breadth With a Fixed IR of 1



Non-Active Bets

Non-active bets are designed to reduce tracking error rather than increase returns. Thus, these bets are used to keep the active manager's return from deviating too far away from the benchmark. Because a manager often uses both active and non-active trades, it is difficult to determine the actual breadth of the portfolio manager. For example, an active manager tracking the S&P 500 may make 50 active bets and 200 non-active bets that are simply tracking the benchmark.

Market Anomaly Strategies

LO 20.4: Demonstrate knowledge of approaches to implementing anomaly strategies.

For example:

- **Recognize methods for integrating anomalies using factor models.**
- **Define pairs trading, and describe the steps involved in constructing the portfolio.**
- **Discuss the effect of short selling on reducing risk and increasing alpha.**
- **Describe the limits to arbitrage and their effect on market efficiency and investment strategies.**

Equity hedge fund managers often use factor models to analyze multiple anomalies rather than rely on a single anomaly to determine when to make trades.

Factor Models

Equity managers often determine a single trading signal using nonparametric approaches such as a ranking system to transform anomaly information. For example, a manager may rank stocks into percentiles or quintiles using a momentum factor. Stocks with stronger momentum would be ranked higher. Other factors such as net stock issuance, price-to-earnings ratios, and earnings announcements are then included in the ranking, and the various factors are used to generate a score for the equities. **Multiple-factor scoring models** blend the factor scores for numerous independent anomaly signals. The models generate a single trading signal by combining scores of numerous anomalies.

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Implementing a Pairs Trading Strategy

Pairs trading is a strategy where stocks are matched based on systematic risk. A long position is established with the undervalued stock, and a short position is held in the overpriced stock. Thus, the strategy hedges against beta or market risk and attempts to generate ex post alpha based on patterns of relative idiosyncratic returns. Pairs traders often have automatic systems that analyze price spreads for pairs of stocks with similar market risk.

The manager implements a pairs trading strategy using the following two steps:

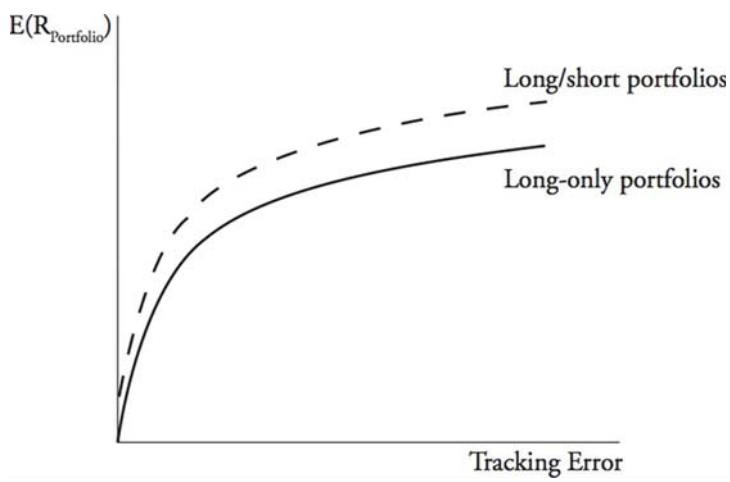
1. Identify pairs of stocks using fundamental analysis (based on industry and size characteristics) or technical analysis (high return correlations) so the pairs of stocks have similar market risk.

2. Analyze the recent price spreads between the two stocks. When the spread abnormally widens, the best performing stock is sold short and the worst performing stock is held long. Thus, the manager anticipates that the prices of the two stocks will converge.

Impact of Short Selling on Reducing Risk and Increasing Alpha

Hedge fund managers with the ability to short sell have a wider breadth of investment opportunities. For example, Figure 3 illustrates the return-risk tradeoff of long/short and long-only investment opportunity sets. The top dashed line represents the expected return and risk tradeoffs for portfolios that allow short sales and have larger breadth. The lower solid line represents the return-risk opportunity set for long-only portfolios. Increased tracking errors result in greater expected returns for both sets of portfolios. However, portfolios that allow short sales have higher expected returns and alphas for every level of risk tracking.

Figure 3: Comparison of the Return-Risk Opportunity Sets With and Without Short Positions



Arbitrage Limits

The **limits to arbitrage** are related to time and size constraints of hedge fund managers or arbitrageurs. Figure 3 illustrates that returns increase at a decreasing rate when portfolios

increase portfolio risk. This diminishing amount of reward per unit of risk creates a limit on the amount of arbitrage activity a hedge fund manager is willing to pursue. One reason for limits to arbitrage is that managers who want to be successful for the long run will limit the risk of the fund. Successful managers do not want to risk the possibility of total ruin by being overly exposed to a bet that goes wrong.

Another reason is related to market structures, such as the inability of institutions to participate in micro-cap stocks. For example, institutions may have too much capital to effectively use trading strategies that focus on companies with small capitalizations. Small-cap stocks have lower liquidity, wider bid-ask spreads, and less volume. These factors combine to influence the degree of market impact. **Market impact** refers to the short-term effect of trades on the size and level of bid-ask spreads.

Other limits to arbitrage are related to the inability to short sell some stocks or entire markets. Regulations may restrict short selling on specific stocks or the market overall in times of crisis. In addition, shares of some firms may not be available for short sales.

Primary Equity Hedge Fund Strategies

LO 20.5: Demonstrate knowledge of the three major strategies of equity hedge funds.

For example:

- **Recognize the mechanics of short selling.**
- **Describe the key characteristics of short-bias hedge funds.**
- **Recognize inferences that can be drawn from comparing definable characteristics of short-bias hedge funds with their historical stand-alone and portfolio performance.**
- **Describe the key characteristics of equity long/short hedge funds.**
- **Recognize inferences that can be drawn from comparing definable characteristics of equity long/short hedge funds with their historical stand-alone and portfolio performance.**
- **Describe the key characteristics of equity market-neutral hedge funds.**
- **Recognize inferences that can be drawn from comparing definable characteristics of equity market-neutral hedge funds with their historical stand-alone and portfolio performance.**

Mechanics of Short Selling

The main difference between traditional (long-only) equity funds and equity hedge funds is the use of short selling (i.e., shorting). When short selling a stock, the fund manager believes that the current price is too high and that it will fall in the future. By executing a short sale, the manager sells high and buys low, so profit is generated from declining prices. This trade requires risk management expertise given its potential for unlimited losses. For example, the worst loss from a long position in a stock is the purchase price of the stock (i.e., the stock could potentially decline to zero). However, when shorting a stock, there is theoretically no upper limit on the stock price, so there is a potential for unlimited losses, but profits are limited because stock prices are capped at zero.

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Short sales are orders to sell securities that the seller does not own. For a short sale, the short seller (1) must simultaneously borrow and sell securities through a lender, (2) must return the securities at the request of the lender or when the short sale is closed out, and (3) must keep a portion of the proceeds of the short sale on deposit with the lender. Given that the lender loans the security to the seller, collateral is required on the short position (typically in the form of a long position). However, this collateral requirement can lead to liquidity concerns when the value of the long position (used as collateral) falls below the amount needed to cover the short position. In illiquid markets, fund managers may be forced to liquidate long positions that are falling in value and buy back short positions that are rising in value. Additionally, the short seller may be forced to close his position if the lender runs out of securities to borrow. This is known as a short squeeze, and the seller will need to close his short position immediately.

The total return from short selling is impacted by (1) capital gain/loss from the security price movement, (2) dividends due to the lender, and (3) short stock rebate on the value of the collateral posted.

The remainder of this learning objective will examine the three major types of equity hedge funds: short-bias, long/short, and market-neutral using the simple one-factor CAPM. In practice, multiple-factor models are most likely used in conjunction with implementing these strategies.

Professor's Note: The CAPM defines the required rate of return for a risk-averse investor. In an efficient market, the alpha for a fund or investment can be viewed as the excess return above what is expected based on the CAPM. The required return of any security or portfolio, R_i, equals the risk-free rate plus the market risk premium times the security's or portfolio's beta: $R_i = R_f + \beta i(R_M - R_f)$.

Short-Bias Hedge Funds

The biggest distinction between short-bias hedge funds and long/short hedge funds is that short-bias hedge funds maintain a net short exposure to market risk. The biggest challenge for managers of short-bias funds is that markets usually rise over time and possess an equity premium. Therefore, short-bias funds will often have low or negative returns in rising markets. However, the value of these funds is in their ability to provide downside protection in declining markets. Another challenge for these strategies involves the reputational and regulatory risks associated with short selling. For example, in the 2008 financial crisis, certain securities in the financial sector and even entire markets of certain countries were restricted from short sales. In addition, **uptick rules** may restrict the implementation of short strategies by restricting short sales to stocks whose last trade represented an increase in the stock price. Lastly, the usefulness of these funds with regard to their contribution to society is also questionable because short strategies are sometimes viewed as a catalyst for a company's failure.

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Example: Investment decision

Suppose markets are efficient and the CAPM is a valid model. Assume the expected return on the market is 10% and the risk-free rate is 3%. Suppose a long-only equity fund has a beta of 1.0 and an expected return of 12%. In addition, a short-bias fund has a beta of –1.0 and an expected return of –2%. **Determine** if an investor should invest in the short-bias fund.

Answer:

The CAPM defines the required rate of return for a risk-averse investor.

The long-only fund has a required return of 10% and an ex ante alpha of 2%.

$$R_{long} = 0.03 + 1(0.10 - 0.03) = 0.10 \text{ or } 10\%$$

$$\text{ex ante alpha}_{long} = 12\% - 10\% = 2\%$$

The short-bias fund has a required return of –4% and an ex ante alpha of 2%.

$$R_{short} = 0.03 + (-1)(0.10 - 0.03) = -0.04 \text{ or } -4\%$$

$$\text{ex ante alpha}_{short} = -2\% - (-4\%) = 2\%$$

If a fund manager or investor combines the two funds with equal weights, the portfolio will have no market risk and a beta of 0 [= 0.5(1) + 0.5(–1)]. The expected return of the portfolio is 5%, calculated as $0.5 \times E(R_{long}) + 0.5 \times E(R_{short}) = 0.5(12\%) + 0.5(-2\%) = 5\%$. The alpha (2%) for this portfolio is the expected return of 5% less the risk-free rate of 3%. The alpha can also be calculated as a weighted average of the alphas from the two funds (i.e., 0.5 × 2% + 0.5 × 2% = 2%). Thus, investors should focus on the relative value of the short fund and not just the absolute value of the fund's returns.

Performance of Short-Bias Hedge Funds

Analyzing historical data of short-bias funds from 2000–2014 using the HFRI Equity Hedge: Short Bias Index as a proxy reveals that the annual average mean return of short-bias funds was approximately zero with a slightly higher standard deviation than world equities. As a result, the Sharpe ratio of short-bias funds was near zero. Short-bias funds underperformed the overall equity hedge fund index with lower returns, a higher standard deviation, and a higher maximum drawdown.

Short-bias funds do appear to possess hedging potential for a portfolio as they have a negative correlation of –0.72 with world equities and earned their highest returns during periods where world equities earned their lowest returns. This suggests short-bias funds have excellent hedging properties when combined with world equities.

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Equity Long/Short Hedge Funds

Equity long/short strategies typically have a net long position and consist of long stock positions combined with a short position. The short position is composed of either short stock positions or short positions in the market created with index options or futures.

Example: Equity/long short portfolio construction

Suppose a long/short fund manager believes that the metals and mining sector will outperform the market and the financial sector will underperform the market due to the high probability of a financial crisis. **Construct** a 140% long/40% short portfolio that allows the manager to capitalize on these expectations.

Answer:

The manager could invest 140% of the fund assets in SPDR XME (metals and mining ETF) and short sell 40% of the fund assets in SPDR XLF (ETF of financial sector of S&P 500). This would create a net exposure 100% long with approximately the same systematic risk as the market portfolio.

Example: Calculating equity/long short total return

Now let us continue the previous example using data from January 2008 to August 2008. The realized returns for SPDR XME and SPDR XLF during this time period were 23% and 33%, respectively. Assuming the manager created a 140/40 hedge fund on January 1, 2008, **calculate** the total return for this fund as of August 2008.

Answer:

$$\text{Total return} = 1.40 \times 0.23 + (-0.40) \times (0.33) = 0.322 + (-0.132) = 0.19 \text{ or } 19\%$$

Example: CAPM return

Continuing the previous example one step further, assume the actual return for the S&P 500 was –13.64% and the risk-free rate of return was 2.25% for this time period. The betas in January 2008 for the SPDR XME and SPDR XLF were 0.99 and 0.98, respectively. What is the required realized return for this portfolio during this period using the CAPM?

Answer:

The portfolio beta is determined by calculating the weighted average of the two betas as follows:

$$1.40 \times (0.99) + (-0.40) \times (0.98) = 1.386 - 0.392 = 0.994$$

$$\text{Required realized return} = 0.0225 + 0.994(-0.1364 - 0.0225) = -0.1354 \text{ or } -13.54\%$$

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These examples illustrate the ability of equity fund managers to exploit temporary inefficiencies in the market. One of the most popular long/short equity funds is the 130/30 equity fund (i.e., 130% of the fund assets in long positions and 30% of the fund assets in short positions). However, these funds have returns that resemble those of market index funds. This indicates that the limited ability of these portfolio managers to take risks means that their alpha returns may not be high enough to justify their high fees.

Performance of Equity Long/Short Hedge Funds

Using historical data from 2000–2014 for the Credit Suisse Long/Short Equity Hedge Index, equity long/short funds have similar mean returns, volatilities, and Sharpe ratios as the overall equity hedge fund index. The return distribution for the long/short strategy possesses positive kurtosis and little skew. Long/short funds are negatively correlated with changes in equity market volatility and changes in credit spreads. Long/short funds are highly correlated with world equities but have comparatively higher returns and a lower standard deviation. Thus, equity long/short funds offer modest diversification benefits for an investment portfolio.

Equity Market-Neutral Hedge Funds

Equity market-neutral hedge funds attempt to create **mean neutrality** or zero beta exposure to market risk. Thus, the funds are designed not to move with or against the market. Some funds may also exhibit variance neutrality. **Variance neutrality** refers to a fund with returns that are uncorrelated with changes in market risk, including crisis situations. The returns of market-neutral hedge funds rely on the skill of the manager as the funds are designed to move independently of the market.

The following three steps describe how a manager implements a market-neutral strategy:

1. Build a screen or set of investible stocks that are closely followed with sufficient liquidity to enter and exit quickly.

2. Analyze the investible stocks to identify overvalued and undervalued stocks for short and long positions, respectively.

3. Use a computer program to weigh the portfolios appropriately and target an overall beta of zero for the portfolio.

Performance of Equity Market-Neutral Funds

Historical data from 2000–2014 for the HFRI Equity Hedge: Equity Market Neutral Index reveals an extremely low annual volatility of 3% for equity market-neutral funds. The average mean returns were also low, resulting in a moderate Sharpe ratio. The minimum monthly return was –2.9%, and the maximum drawdown for this period was –9.2% revealing the strong downside protection of this strategy. The low volatility and low correlation with world equities and extreme market events are the most attractive attributes of this strategy.

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Equity Hedge Fund Risks

LO 20.6: Demonstrate knowledge of risk associated with equity hedge funds.

For example:

- **List major types of risk associated with equity hedge funds.**

The major types of equity hedge fund risks relate to (1) equity market risks, (2) quantitative versus fundamental strategies, (3) concentrated positions and liquidity, and (4) regulatory changes:

- *Equity market risks*: Fund managers face increased risk when the market moves opposite of expectations. For example, long/short equity funds risk losses during bear markets given their net long exposure. Conversely, short-bias equity funds risk losses during bull markets given their net short exposure.
- *Quantitative versus fundamental strategies*: Quantitative strategies (i.e., black box models) expect stock prices to follow forecasts from factor models. If these stock prices behave differently than forecasted, the equity hedge fund may generate negative alpha. Additionally, fundamental strategies that depend on the expert opinion of fund managers may not add value in certain economic environments.
- *Concentrated positions and liquidity*: Large, concentrated positions can significantly influence a stock price when traded. Thus, liquidity risk may be present as position sizes increase. It is recommended that fund managers limit position size in accordance with a position's average daily volume.
- *Regulatory changes*: Equity hedge fund strategies can be significantly impacted by regulatory changes, such as a periodic ban on short selling.

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Key Concepts

LO 20.1

- **Equity hedge funds** establish long positions in undervalued equities and short positions in overvalued equities. The mix of the long/short positions determines the amount of systematic risk exposure. Common strategies include equity long/short funds, equity market-neutral funds, and short-bias funds.
- Hedge funds earn excess returns by playing an important role as **market makers** in providing liquidity.
- Equity hedge fund managers trade on temporary inefficiencies that often include short positions. These managers face less competition for finding overvalued stocks. **Asynchronous trading** and market overreactions and underreactions are other examples of information inefficiencies where hedge fund managers are rewarded with **complexity premiums**.
- Hedge fund managers may speculate by taking on abnormal risk in exchange for abnormal returns.

LO 20.2

- Market efficiency tests are joint tests determining the validity of the market model and the existence of market anomalies. Thus, it is difficult to know if abnormal returns are the result of **model misspecification** or market inefficiencies.
- Management of firms have incentives to meet market expectations, and studies find that when a firm reports net income significantly higher than operating cash flows, future negative earnings surprises are more likely to occur.
- Hedge fund managers establish positions based on changes in a firm's total accruals where total accruals = $\Delta CA - \Delta CL - \Delta Cash + \Delta STDEBT - D\&A$.
- **Price momentum** refers to the tendency of a higher expected price when there is an upward trend in prices and a lower expected price when there is a downward trend in prices.
- **Earnings momentum** suggests that changes in earnings are positively correlated over time. When actual earnings exceed (are below) expected earnings, in the results is a positive (negative) surprise. One method used to measure earnings surprises is **standardized unexpected earnings (SUE)** = (EPS – ACEPS) / SDEM.
- Equity hedge fund managers establish long positions in firms with share buyback programs and short positions in firms issuing large amounts of new stock.
- **Legal insider trading** involves basing trades on the trading actions of senior executives.

LO 20.3

- The **information coefficient (IC)** measures managerial skill as the correlation between actual realized and forecasted managerial returns.
- The **Fundamental Law of Active Management (FLOAM)** links the breadth (active bets) and skill (IC) of the manager to the information ratio (IR) as follows:

$$IR = IC \times \sqrt{breadth}$$

- **Non-active bets** are designed to reduce tracking error rather than increase returns.

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LO 20.4

- **Multiple-factor scoring models** generate a single trading signal based on combining scores from numerous anomalies.
- **Pairs trading** strategies match stocks based on systematic risk. A long position is established in the undervalued stock, and a short position is held in the overpriced stock. The hedge fund profits if the stock prices converge.
- Portfolios that allow short sales have higher expected returns and alphas for every level of risk tracking than long only portfolios.
- The **limits to arbitrage** are related to time and size constraints of hedge fund managers, market structures, and inabilities to establish short positions due to market restrictions or lack of supply of shares.

LO 20.5

- Short sales are orders to sell securities that the seller does not own. The short seller sells high and buys low, and profit is generated when the short security declines.
- The biggest distinction between short-bias hedge funds and long/short hedge funds is that short-bias hedge funds maintain a net short exposure to market risk.
- Short-bias funds have a –0.72 correlation with world equities, implying excellent hedging properties.
- Equity long/short strategies typically have a net long position.
- Long/short funds and the equity hedge fund index have similar mean returns, volatilities, and Sharpe ratios.
- Market-neutral hedge funds attempt to create **mean neutrality,** or zero beta exposure to market, risk and, therefore, do not move with the market.
- Low volatility and low correlation with equities and extreme market events are the most attractive attributes of market-neutral strategies. However, the low volatility implies large allocations to market-neutral funds are required to gain diversification benefits.

LO 20.6

The major types of risk associated with equity hedge funds include (1) equity market risks, (2) quantitative versus fundamental strategies, (3) concentrated positions and liquidity, and (4) regulatory changes (e.g., short selling bans).

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Concept Checkers

1. A large pension desires to increase its position in a health care stock substantially. It starts acquiring the stock at the beginning of the trading day, but the price gradually increases throughout the day. An equity hedge fund manager steps in and starts selling a large number of shares of health care stock. In this example, the pension fund is:
   A. a market maker.
   B. taking liquidity.
   C. providing liquidity.
   D. overreacting.

2. An equity fund manager focuses on individual firms' accruals to determine long and short positions with their underlying stocks. Which of the following trades is the equity fund manager *most likely* to make?
   A. A long position in a company with an increase in noncash current assets.
   B. A long position in a company that is increasing the amount of deferred accounts payable.
   C. A short position in a company that is reducing the percentage of credit sales.
   D. A short position in a company that has decreasing depreciation expenses.

3. Suppose an active manager has a fixed IR of 1. If the manager makes 80 bets per year, what is her skill level measured by the IC?
   A. 0.316.
   B. 0.200.
   C. 0.112.
   D. 0.100.

4. An equity fund manager implements pairs trading by identifying pairs of stocks with similar:
   A. market risk and analyzing historical spreads.
   B. historical spreads and varying betas.
   C. characteristics but low correlations.
   D. idiosyncratic risks but opposite market risk.

5. What would be the portfolio beta of a 130/30 equity hedge fund with a long position using stocks with a beta of 1.2 and a short position using stocks with a beta of 1.1?
   A. 0.05.
   B. 1.15.
   C. 1.23.
   D. 1.89.

6. Which of the following actions would *most likely* subject an equity hedge fund to significant losses?
   A. The financial regulatory environment for a given period remains unchanged.
   B. A fund manager implements a long/short equity strategy during a bear market.
   C. A fund manager uses a quantitative model that closely follows the behavior of stock prices.
   D. A fund manager decides to limit equity position size to reflect that position's average daily volume.

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Concept Checker Answers

1. **B** An institution that is taking liquidity reduces the current supply of available sellers in order to increase its long-term position. (LO 20.1)

2. **D** A company with decreasing depreciation expenses will have higher earnings and lower free cash flows. Therefore, the hedge fund manager would most likely short this company. A long position would not be established in a company with increases in current assets such as inventory or accounts receivables. The manager would also not have a long position in a company that is reducing expenses in a current year and deferring them to the next period. This would reduce next period's earnings. Lastly, the manager would expect future earnings to improve if fewer sales are from credit and, thus, more accurately reflect the current period's actual cash flows. (LO 20.2)

3. **C** Assuming the IR is a constant 1.0 in the FLOAM relationship, 1.0 divided by the square root of the number of active betas determines the IC as follows:

   $$\text{IR} = \text{IC} \times \sqrt{\text{breadth}}$$
   $$1 = \text{IC} \times \sqrt{80}$$
   $$1/8.94427 = \text{IC}$$
   $$0.112 = \text{IC}$$

   (LO 20.3)

4. **A** An equity fund manager implements pairs trading by identifying pairs of stocks with similar market risk and analyzing historical spreads. (LO 20.4)

5. **C** Portfolio beta = 1.30 × 1.2 + (–0.30) × 1.1 = 1.56 – 0.33 = 1.23 (LO 20.5)

6. **B** Long/short equity funds risk significant losses during bear markets given their net long exposure. A short-bias equity fund would perform better during a bear market. A fund manager should limit position size in accordance with a position's average daily volume. If stock prices behave similar to what is expected by a quantitative model, the equity hedge fund may generate positive alpha. Finally, equity hedge funds are most concerned with regulatory changes, such as periodic short selling bans. (LO 20.6)

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The following is a review of the Hedge Funds principles designed to address the learning objectives set forth by the CAIA Association®.

Funds of Hedge Funds

Topic 4.6

Exam Focus

This topic review focuses on the benefits and costs of diversification using funds of funds (FOFs). Hedge funds with assets under $50 million benefit the most from FOFs due to fee structures and expenses. Multistrategy funds have lower fees, tactical allocation, and transparency advantages over FOFs. FOFs have greater access to skilled managers and reduce idiosyncratic manager risk and operational risk more effectively. Know how many funds are required to achieve diversification based on empirical and theoretical studies. Lastly, candidates should be able to describe the characteristics of major strategies and contrast the historical return data in terms of mean returns, volatility, Sharpe ratios, correlations, and diversification benefits.

Diversification: Benefits and Costs

LO 21.1: Demonstrate knowledge of the benefits and costs of diversification in hedge fund investing.

For example:

- **Define funds of hedge funds.**
- **Recognize how indices can serve as valuable tools in constructing hedge fund portfolios and analyzing portfolio performance.**
- **Describe the functions of funds of hedge funds.**
- **List the benefits to investing in funds of hedge funds.**
- **List the disadvantages to investing in funds of hedge funds.**
- **Evaluate how funds of hedge funds add value.**
- **Discuss and determine the relationship between the number of funds in a portfolio and the level of diversification.**
- **Describe the process for identifying funds for an institutional portfolio or fund of funds.**

Funds of Funds: Definition and Functions

Funds of funds (FOFs) are hedge funds that create portfolios consisting of other hedge funds. Diversification benefits are gained through FOFs. However, the major cost of including FOFs in an investment portfolio is the additional layer of fees paid to the FOF manager.

An FOF performs the following four functions for investors:

1. Selecting the hedge fund managers and strategies in which to invest.

2. Constructing portfolios of hedge fund investments and allocating assets among them, based on their return and risk profile as well as their size, liquidity, and lockup periods.

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3. Monitoring the hedge fund investments and managing the FOF's overall risk exposure.

4. Performing due diligence on hedge fund managers, including operational due diligence of their internal controls, policies, and procedures. One reason large FOFs may tend to outperform smaller FOFs net of fees is that the larger ones achieve economies of scale in their due diligence function.

Using Indices for Portfolio Construction and Analysis

Indices are valuable tools for analyzing portfolio performance and constructing hedge fund portfolios. By examining index return data over time, investors calculate historical return correlations for hedge funds relative to both other asset classes and across hedge fund strategy-specific indices. For example, an investor seeking additional portfolio diversification by adding exposure to relative value hedge funds should consider the strategy's historical correlations with existing portfolio components (e.g., world equities, funds of hedge funds, and equity hedge funds) to determine its appropriate portfolio weight.

Benefits of FOFs

FOFs offer the following 11 advantages to investors:

1. Greater diversification among hedge fund investments than many investors can achieve on their own.

2. Lower minimum investments than the $500,000 that is typically required for a single hedge fund.

3. Economies of scale with respect to the costs of hedge fund investing such as manager selection and due diligence.

4. Informational advantages such as industry contacts and access to data providers.

5. Better liquidity than individual hedge fund investments, which typically have lockup and notice periods and infrequent redemptions.

6. Access to hedge funds that have been closed to new investments by investing in an FOF that has these funds in its portfolio,

7. The ability to negotiate reduced fees with some of the hedge funds in which they invest.

8. Greater regulatory protection because many FOFs are registered in jurisdictions where they are more closely regulated than are the hedge funds in their portfolios.

9. Currency hedging by FOFs that have exposure to foreign exchange risk.

10. Use of leverage by some FOFs.

11. A means of gaining education about the hedge fund sector for novice hedge fund investors.

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Disadvantages of FOFs

Investing in FOFs also has the following six disadvantages:

1. FOF investors effectively pay a double layer of fees that typically includes a 1-and-10 fee structure to the FOF itself in addition to the 2-and-20 fee structure typically charged to the FOF by the hedge funds in its portfolio.

2. Performance fees are not netted within the FOF's portfolio. Even if the FOF itself does not earn performance fees, it might have to pay performance fees to some of the funds in its portfolio.

3. As with individual hedge funds, FOFs may have adverse tax consequences for some investors.

4. Some FOFs exhibit a lack of transparency by not disclosing the investments in their portfolios.

5. FOF investors are exposed to the effects of cash flows from other investors that may require the FOF to carry out unwanted changes to its portfolio.

6. Compared to investing directly in hedge funds, investing in FOFs offers less control in terms of asset management and style allocation.

How FOF Managers Add Value

The reason an FOF earns a second layer of fees is active management of the FOF portfolio can add value compared to selecting a portfolio of hedge funds at random. This added value derives from strategic allocation, tactical allocation, and manager selection:

- **Strategic allocation** refers to the FOF's long-term percentage allocation of capital to each category of hedge fund style or strategy (e.g., equity and macro).
- **Tactical allocation** refers to deviating from the FOF's strategic allocations to take advantage of perceived short-term opportunities.
- **Manager selection** involves choosing which specific hedge funds to invest in. Liquidity is a consideration here because more liquid funds may give the FOF more opportunity for active allocation among managers.

Diversification

Empirical studies suggest using 15 to 20 hedge funds to optimize diversification benefits. When hedge fund portfolios are constructed across 15 or more hedge funds, the volatility of the portfolios are similar to that of a fixed-income investment. The marginal benefits of holding more than 20 hedge funds are minimal.

The time horizon is also an important factor in measuring the degree of diversification. Studies reveal that for a one-year time horizon, a portfolio of eight hedge funds results in a portfolio standard deviation that is 50% of the average individual hedge fund standard deviation. When the time horizon is 5 to 10 years, a portfolio of as few as five hedge funds has a standard deviation that is less than 50% of the average individual hedge fund standard deviation.

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Theoretical approaches to estimating the impact of diversification are based on the assumption that all assets in the portfolio have equal weights, volatility, and amounts of systematic risk and are uncorrelated. Under these assumptions, the standard deviation of the portfolio is defined as:

$$\sigma_p = \frac{\sigma_f}{\sqrt{n}}$$

where:
σ_f = standard deviation of each fund in the portfolio
n = number of funds in the portfolio

Example: Estimating the standard deviation of a hedge fund portfolio

Assuming all of the individual funds have a standard deviation of 40% and equal systematic risk, **calculate** the estimated standard deviation of an equally weighted portfolio of 25 hedge funds.

Answer:

$$\sigma_p = \frac{0.40}{\sqrt{25}} = 0.08 = 8\%$$

Selecting Portfolio Funds

The hedge fund universe contains thousands of hedge funds. FOFs and institutional portfolios use the following steps to select managers from the large number of available fund managers.

Step 1: Quantitative screens identify specific characteristics of the funds related to minimum track records for the managers, minimum return, and maximum risk for similar styles. Thus, a hedge fund database of over 4,000 funds can quickly be reduced to 500 or fewer funds.

Step 2: Due diligence requires meeting and further analyzing the hedge fund managers. This is where FOFs have a significant advantage. FOFs possess proprietary knowledge of the performance of individual managers that is not available to the public. Initial meetings may reduce the managers under consideration to 100–200.

Step 3: On-site visits to meet the staff of the fund and determine the skill level of the manager narrow down the remaining list of hedge fund managers. The final step in the selection process also involves reference checks. The final list of funds deemed suitable for investment should contain approximately 10–50 funds.

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Multistrategy Funds

LO 21.2: Demonstrate knowledge of investing in multistrategy funds.

For example:
- **Evaluate and determine fee-related advantages of multistrategy funds.**
- **Evaluate flexibility and transparency in the context of multistrategy funds.**
- **Evaluate potential advantages related to manager selection and operational risk management by funds of funds.**

Multistrategy funds are structured with a single portfolio manager delegating the fund's assets across a variety of internal submanagers and hedge fund strategies.

Fee Advantage

The major advantage of the multistrategy funds to investors is that they charge significantly lower incentive fees. One reason they can do this is they avoid the second level of fees that are inherent with a FOF. The fee structure of most multistrategy funds is 2 and 20. FOFs typically have a total fee structure of 3 and 30 (i.e., 2 and 20 plus 1 and 10). A second reason is the incentive fees in a multistrategy fund are based on the aggregated returns of all underlying strategies, while each fund in a FOF is paid an incentive fee, if eligible. That is, in a FOF structure, strategies that earn profits are not netted against strategies that earn losses before incentive fees are paid, while in a multistrategy fund, **fee netting** occurs.

Flexibility and Transparency Advantages

Relative to FOFs, multistrategy funds have greater flexibility in making tactical allocation adjustments and greater transparency. FOF managers may have over 20 different hedge fund managers with which they have invested. Each of these hedge fund managers may have a lockup period that is initially one year. After the first year, lockup periods are often reduced to quarterly terms. In addition, many hedge fund managers use proprietary models and, therefore, provide little transparency regarding the holdings of underlying funds. Therefore, it is very difficult to use tactical allocation and quickly transfer funds from one hedge fund to another under the FOF structure.

Conversely, the multistrategy fund manager has real-time access to all positions. This transparency allows the multistrategy fund manager to manage the total risk of the fund with portfolio-level hedges. The manager would not be able to fully hedge the risk without the transparency revealing the complete position information from every fund.

Manager Selection and Operational Risk Management Advantages

FOF managers have access to a universe of over 8,000 single-strategy fund managers. A multistrategy fund manager hires trading teams for various strategies that the manager wishes to implement. The multistrategy fund manager typically hires between one to five traders for each strategy. If the manager is implementing 10 strategies, the manager may have as many as 50 traders. The FOF manager clearly has access to substantially more single-fund strategy managers. This is an important factor considering that studies indicate the average difference in returns for the top and bottom quartiles of hedge fund managers is 7% within specific styles. Thus, manager selection is much more important for hedge funds than traditional fund managers.

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Another advantage of FOFs over multistrategy funds relates to operational risk. FOF managers diversify operational risks over 10 to 20 independent organizations and managers. The multistrategy fund has a single operational infrastructure. A catastrophic event in one strategy could lead to the demise of the entire multistrategy fund. Conversely, if one fund fails under a FOF structure where there are 10 equally sized investments in independent managers, then this would only be a loss of 10% for the entire FOF without any impact on the other funds.

Agarwal and Kale (2007)[1] find that multistrategy funds outperform FOFs substantially on a risk-adjusted basis by at least 3% per year and attribute the difference to a manager **self-selection effect** in which the best managers choose to run a multistrategy fund rather than work for a FOF.

Funds of Hedge Funds

LO 21.3: Demonstrate knowledge of the process of investing in funds of hedge funds.

For example:
- **Identify advantages that funds of funds have over direct hedge fund investments.**
- **Discuss empirical evidence regarding fund of funds returns and the potential for reduced biases in reported performance.**
- **Recognize the varying investment objectives of funds of hedge funds.**
- **Describe how funds of funds can act as venture capitalists.**

Advantages Relative to Direct Hedge Fund Investments

The two major advantages of FOFs are the ability to access the top managers and the ability to reduce the idiosyncratic risk of individual hedge fund managers. Manager **access** refers to the ability of an investor to add new or additional funds to a particular manager's fund. Successful hedge fund managers may limit capacity in order to keep expected returns high. These fund managers will often close their hedge funds to new investors. FOFs have access to fund managers that are closed to new investors. The idiosyncratic risk of a single hedge fund manager refers to the failure of the manager due to mistakes, unfavorable industry factors, or a manager style that is no longer effective.

The size of the FOF also offers advantages. Large FOF managers often establish lines of credit with banks known as **liquidity facilities** that are designed to help bridge the funds' subscriptions and redemptions. Furthermore, FOFs offer diversification benefits and management expertise similar to mutual funds. FOFs also can place assets in managed or separate accounts to reduce operational costs and improve transparency. The managed account allows the hedge fund managers to trade the assets while the FOF manager controls the custody of the assets. This significantly reduces the risk that the fund manager will misrepresent the performance and provides the FOF manager with complete transparency.

[1] Agarwal and Kale. "On the Relative Performance of Multi-Strategy and Funds of Hedge Funds." *Journal of Investment Management*, 5(3) (2007), p. 41–63.

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Empirical Performance and Reduced Biases

Empirical studies reveal that FOFs underperform broad hedge fund indices. However, these results are misleading if FOFs are less affected by survivor bias and selection bias compared to individual hedge funds.

Possible reasons that FOFs are less biased than individual hedge funds are:

- FOFs retain the returns of liquidated funds in their track record. Survivor bias is present in broader indices when returns from failed funds are removed from the data.
- FOFs include hedge fund investment returns from the date of the investment and, therefore, reduce instant history bias.
- FOFs use actual weights that are more reflective of investments in practice.

Investment Objectives of Funds of Hedge Funds

HFR compiles funds of hedge funds into the following subindices: composite, diversified, conservative, market-defensive, and strategic.

The **composite** and **diversified indices** include equity, event-driven, macro, and relative value strategies. These two indices most closely represent the broad hedge fund universe. Therefore, investment objectives of these funds reflect the overall objectives of hedge fund investors that seek higher return opportunities.

The **conservative index** includes equity market-neutral, relative value, and event-driven strategies that exhibit lower standard deviations. As the name implies, the objective is to obtain consistent returns with low risk.

The **market-defensive index** includes FOFs with little downside risk and low correlations with equities and bonds. This index typically has large allocations to macro, systemic, and short funds. The overall objective of market-defensive strategies is to hedge market risk.

The **strategic index** includes directional strategies of equity hedge and emerging market funds and other strategies that maximize total returns. Thus, the high returns are a key objective for these directional strategy bets.

FOFs as Venture Capitalists

Hedge funds of funds that resemble venture capitalists are referred to as seeding funds. **Seeding funds** invest in new hedge funds to obtain transparency and capacity with the new fund managers. The seeding fund gains a stake in the hedge fund for providing legal expertise, infrastructure, and contact information. Thus, it is an effective approach for assuring future transparency and capacity with the new hedge fund managers in the long run and can be quite profitable for the fund of funds.

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Building an FOF

LO 21.4: Demonstrate knowledge of building a portfolio of single hedge funds.

For example:
- **Contrast the fees associated with a fund of funds with those of a portfolio of single hedge funds.**
- **Discuss costs associated with hedge fund due diligence and minimum investment sizes.**

The costs of using a FOF approach should be compared to the cost of maintaining an internal staff to manage a portfolio of single hedge funds. FOFs require a second layer of fees that include a management fee of 1% and a performance fee of 10%. An investor should compare these fees to the expenses it would incur in selecting its own hedge fund managers and performing its own due diligence, such as the cost of visiting each potential manager. Studies estimate that the total minimum cost of maintaining an internal staff and an internal evaluation system is $1 million.

If we assume average annual performance fees of 1% for FOFs in addition to their 1% management fee, total combined fees of 2% may be preferred to the $1 million internal costs for managing a hedge fund portfolio of less than $50 million (i.e., $1 million / 0.02). An internally managed portfolio of single hedge funds may be more cost-effective for investing an amount greater than $50 million.

Minimum investment sizes are also a consideration. With a median hedge fund minimum investment size of $500,000, an investor would need at least $10 million to create a reasonably diversified portfolio of 20 hedge funds, even before considering administrative costs.

Hedge Fund Liquid Alternatives

LO 21.5: Demonstrate knowledge of multialternatives and other hedge fund liquid alternatives.

For example:
- **Contrast liquid alternatives with a private alternative investment vehicle, such as hedge funds, CTAs, and funds of funds.**
- **Discuss areas where UCITS regulation is more strict than that for private placements.**
- **Discuss restrictions on '40 Act funds.**
- **Compare and contrast relative value hedge funds, event-driven hedge funds, and macro and managed futures funds in the context of the regulatory framework for liquid alternative investments.**
- **Discuss why multialternatives are popular as liquid alternatives.**
- **Discuss empirical evidence regarding historical returns of liquid alternatives.**

Professor's Note: We introduced liquid alternative investments, the UCITS Directive, and the '40 Act in "Topic 2.2: The Environment of Alternative Investments."

Hedge fund liquid alternatives are publicly traded funds that employ hedge fund-like strategies. Their fees and minimum investment sizes are lower than those of privately placed hedge funds. Liquid alternatives are subject to regulations that make them more transparent than privately placed hedge funds but give their managers less flexibility. For example, liquid alternatives are more limited in their ability to employ leverage and short positions in the types of assets in which they may invest. As a result, liquid alternatives have lower risk and lower expected returns on average compared to private placements.

Regulation of Liquid Alternatives

Investment vehicles that comply with Europe's Undertakings for Collective Investment in Transferable Securities (UCITS) regulations are more limited than privately placed hedge funds in terms of their risk, liquidity, and transparency. The following are some of the areas in which UCITS regulation is stricter:

- *Fund holdings*: UCITS-compliant funds are restricted from investing in private equity, commodities, and real assets.
- *Leverage*: The UCITS Directive limits leverage to 200% of net asset value.
- *Diversification*: The UCITS Directive restricts funds from investing more than 35% of assets in sovereign debt of a single EU issuer, 20% in a single investment fund, 10% in illiquid investments, or 10% in a single corporate issuer (20% including derivatives). In addition, a fund may not deposit more than 20% of assets in a single financial institution.

In the United States, publicly traded investment vehicles must comply with the Investment Company Act of 1940 (the '40 Act). Provisions of the '40 Act that apply to liquid alternatives include the following:

- *Liquidity*: Funds must offer regular liquidity and fulfill redemptions within seven days.
- *Symmetric performance fees*: If managers of a '40 Act-compliant fund charge a performance fee on investment gains, they must also reimburse investors the same percentage of investment losses. In practice, '40 Act-compliant funds tend not to charge performance fees.
- *Leverage*: The '40 Act requires 300% asset coverage. That is, borrowing and short positions are limited to 33% of assets.
- *Fund holdings*: Illiquid investments are limited to 15% of assets.
- *Diversification*: A fund may invest 25% of assets without concentration limits. The remaining 75% of the portfolio is limited to 5% in a single issuer, 25% in a single industry, and 10% of any company's shares.

Liquid Alternative Strategies

Not all hedge fund strategies are equally accessible through liquid alternatives. In general, the more liquid the underlying assets employed in a hedge fund strategy, the more likely it is to have liquid alternatives. For example, equity hedge fund strategies such as long/short and market neutral are widely available as liquid alternatives, in part because these strategies are often carried out in ways that are compatible with the UCITS Directive or the '40 Act.

Managed futures strategies have liquid alternatives that use swaps to transfer the returns on managed futures funds into a structure that complies with the '40 Act. Liquid alternatives for macro strategies are available but are more limited than a privately placed macro fund in their use of leverage and concentrated asset positions.

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Event-driven and relative value strategies are unlikely to have liquid alternatives. Many of the underlying assets used in event-driven strategies, such as distressed securities, are not liquid enough to allow a fund to meet the UCITS Directive or '40 Act requirements. Relative value strategies typically involve more leverage than a UCITS- or '40 Act-compliant fund is permitted to use.

Liquid alternatives can also use non-hedge fund strategies. For example, **nontraditional bond funds** (also known as **unconstrained bond funds**) invest in riskier debt than traditional bond funds. This fund type has a larger credit exposure relative to traditional bond funds as it pursues higher yielding debt and may use leverage and shorting.

Multialternative funds (or *multialternatives*) are liquid alternatives that use strategies similar to a fund of funds. These are attractive to investors because a single multialternative represents a diversified portfolio of hedge fund strategies. They can also offer a degree of exposure to strategies that are not otherwise available through liquid alternatives. A multialternative may include some highly leveraged or illiquid strategies in its portfolio, as long as the multialternative as a whole complies with regulations such as the '40 Act.

Performance of Liquid Alternatives

While the lower risk of regulated liquid alternatives suggests they should have lower returns, they also have lower fees than privately placed hedge funds, so we should compare their historical returns on a net-of-fees basis. One approach to comparing liquid alternatives' returns with private placements' returns is a matched sample test, which samples from among managers who offer a hedge fund and a liquid alternative with the comparable strategy. A recent study[2] using this technique confirms that liquid alternative funds had lower risk than comparable hedge funds, but on average, the net-of-fees returns for liquid alternatives were within 1% of the returns for hedge funds. These results varied by strategy. For strategies that employ high leverage, the difference in net-of-fees returns was greater than 2%.

Another study[3] looked at equity long/short mutual funds relative to equity long/short hedge fund indices. The study concluded that single-manager equity long/short mutual funds have similar exposures and return performance as the hedge fund indices.

Finally, a third study[4] concluded that '40 Act funds operated by hedge fund managers outperform '40 Act funds as a whole by 0.7% annually and experience lower drawdowns, but underperform comparable hedge funds by 0.7% annually.

2. Cliffwater LLC, *Performance Private versus Liquid Alternatives: How Big a Difference?* 2013.
3. David McCarthy, *Hedge Funds versus Hedged Mutual Funds: An Examination of Equity Long/Short Funds*, Journal of Alternative Investments 16, no. 3 (2014): 6–24
4. Barclays, *Going Mainstream: Developments and Opportunities for Hedge Fund Managers in the '40 Act Space*, April 2014.

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Performance of Funds of Hedge Funds

LO 21.6: Demonstrate knowledge of historical performance of funds of hedge funds.

For example:

- **Recognize inferences that can be drawn from comparing definable characteristics of market-defensive funds of funds with their historical stand-alone and portfolio performance.**
- **Recognize inferences that can be drawn from comparing definable characteristics of conservative funds of funds with their historical stand-alone and portfolio performance.**
- **Recognize inferences that can be drawn from comparing definable characteristics of strategic funds of funds with their historical stand-alone and portfolio performance.**
- **Recognize inferences that can be drawn from comparing definable characteristics of diversified funds of funds with their historical stand-alone and portfolio performance.**

In this learning objective, market-defensive, conservative, strategic, and diversified FOFs are compared to composite index FOFs from 2000–2014 using the HFRI FOF: Composite and its four subindices.

Performance of Market-Defensive FOFs

Market-defensive FOFs are constructed with short positions and managed futures. Market-defensive FOFs are designed to have negative correlations with major market indices. The average monthly returns of market-defensive FOFs have a high mean return and very low volatility that result in a high Sharpe ratio of 0.6. The return distribution exhibited skewness and excess kurtosis near zero. Market-defensive FOFs are positively correlated with global bonds and commodities. Although they are designed to have negative correlations with world equities, the historical correlations were slightly positive. Market-defensive FOFs also had very low downside risk based on minimum monthly returns and maximum drawdown. Overall, market-defensive FOFs exhibited modest diversification benefits.

Performance of Conservative FOFs

Conservative FOFs are constructed with hedged positions to generate consistent returns using equity market-neutral, fixed-income arbitrage, and convertible arbitrage strategies. The historical average monthly returns of conservative FOFs have a low mean return, low volatility, and a moderate Sharpe ratio of 0.3. The return distribution exhibited extreme negative skewness and very high kurtosis. These properties are reflected in the high downside risk measured by minimum monthly returns and maximum drawdowns. Conservative FOFs are positively correlated with world equities, global bonds, U.S. high-yield bonds, and commodities and are negatively correlated with credit spreads and equity volatility. The correlations with world equities tend to be higher in the worst months and are also influenced by outliers. This suggests little diversification benefits in market crisis situations.

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Performance of Strategic FOFs

Strategic FOFs are constructed using directional bets related to emerging market, sector, and equity strategies. The historical average monthly returns for strategic FOFs are similar to the composite FOFs index with modest mean returns, low volatility, and a moderate Sharpe ratio of 0.2. The return distribution had moderate negative skewness and moderate positive excess kurtosis. They also have moderate downside risk as measured by minimum monthly returns and maximum drawdowns. Strategic FOFs are positively correlated with world equities, U.S. high-yield bonds, global bonds, and commodities and are negatively correlated with credit spreads and equity volatility. Strategic FOFs have modest diversification benefits, and correlations were asymmetric, indicating that correlations are higher in downward markets.

Performance of Diversified FOFs

As the name implies, **diversified FOFs** represent a wide range of strategies and managers. The historical average monthly returns were similar to the composite index with modest mean returns, low volatility, and a moderate Sharpe ratio of 0.3. The return distribution was negatively skewed with positive excess kurtosis. This reflects the poor performance of diversified FOFs during the recent 2008 financial crisis. Diversified FOFs are positively correlated with world equities, global bonds, U.S. high-yield bonds and commodities and are negatively correlated with credit spreads and equity volatility. They have modest diversification benefits and have the highest correlations with world equities.

Professor's Note: While three of the four strategies had a Sharpe ratio of 0.2 to 0.3, differences in mean, volatility, skewness, and kurtosis levels means that each index's performance was still somewhat distinctive.

Figure 1: Historical Performance of Hedge Fund Strategies, 2000–2014

	Annualized Arithmetic Mean	*Annualized Standard Deviation*	*Skewness*	*Sharpe Ratio*	*Maximum Drawdown*	*Correlation With Global Equity*
HFR FOF: Composite	3.8%	5.2%	–1.1	0.3	–22.2%	0.70
HFR FOF: Market-Defensive	5.3%	5.1%	0.2	0.6	–10.9%	0.14
HFR FOF: Conservative	3.5%	3.9%	–2.3	0.3	–20.4%	0.65
HFR FOF: Strategic	3.8%	7.1%	–0.6	0.2	–26.8%	0.74
HFR FOF: Diversified	3.8%	5.1%	–1.1	0.3	–21.8%	0.66
Traditional Benchmarks						
Global Equity	4.4%	15.8%	–0.7	0.1	–54.0%	
Global Bonds	5.7%	5.9%	0.1	0.6	–9.4%	
U.S. High Yield	7.7%	10.0%	–1.0	0.6	–33.3%	
Commodities	3.8%	23.3%	–0.5	0.1	–69.4%	

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Key Concepts

LO 21.1

- Diversification benefits are the major advantage of using FOFs, while the major disadvantage of FOFs is the second layer of fees for the FOF manager.
- Functions of an FOF include selecting managers and strategies, constructing portfolios and allocating assets across hedge funds, monitoring the investments and the FOF's risk exposure, and performing due diligence on hedge fund managers.
- Benefits of FOFs include diversification, low minimum investments, economies of scale, informational advantages, liquidity, access to closed funds, the ability to negotiate reduced fees, regulatory protection, currency hedging, leverage, and an educational role.
- Disadvantages of FOFs include a double layer of fees, performance fees that are not netted, adverse tax consequences, potential lack of transparency, effects of cash flows from other investors, and less control for the investor.
- FOF managers add value through strategic allocation, tactical allocation, and manager selection.
- Empirical studies suggest holding 15 to 20 hedge funds for a well-diversified portfolio. Theoretical approaches estimate the standard deviation assuming all assets have equal weights, volatility, and amounts of systematic risk using the following formula:

$$\sigma_p = \frac{\sigma_f}{\sqrt{n}}$$

- FOFs and institutional portfolios reduce the large number of available fund managers down to a few through quantitative screens, due diligence, and on-site visits.

LO 21.2

- Multistrategy funds have advantages over FOFs with respect to fees, transparency, risk management, and tactical allocation.
- FOFs have major advantages over multistrategy funds in terms of manager selection and operational risks.

LO 21.3

- Two major advantages of FOFs are that they have access to the best managers and reduce the idiosyncratic risk of individual hedge fund managers.
- FOF managers may also have lines of credit with banks known as a **liquidity facility** that are designed to help bridge the fund's subscriptions and redemptions.
- FOFs retain the returns of liquidated funds in their track record, thus reducing survivor bias.
- FOFs include hedge fund returns from the date of the investment, thus reducing instant history bias.
- FOFs use actual weights that may be more reflective of investments in practice.
- HFR compiles funds of hedge funds indices into the following categories: composite, conservative, diversified, market-defensive, and strategic.
- **Seeding funds** invest in new hedge funds to obtain transparency and capacity with the new fund managers.

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LO 21.4

- Due to a median minimum investment size of $500,000, creating a diversified portfolio of hedge funds would require investing at least $10 million.
- The second layer of fees charged by an FOF should be compared to the cost to an investor of building a diversified portfolio of hedge funds. The cost of creating and maintaining an internal evaluation system has been estimated to be $1 million. This suggests a hedge fund portfolio would need to be at least $50 million to make independent management cost-effective compared to FOF investing.

LO 21.5

- Hedge fund liquid alternatives have lower minimum investments, lower fees, and greater transparency than privately placed hedge funds but are subject to more regulation and thus are less flexible for their managers.
- Liquid alternatives are regulated by the UCITS Directive in Europe and the '40 Act in the United States.
- The UCITS Directive limits leverage to 200% of NAV; restricts investments in real assets, private equity, and commodities; and limits asset concentrations in single funds, issuers, and institutions.
- The '40 Act regulates liquid alternatives' leverage and diversification and requires regular liquidity and symmetric performance fees.
- The largest segments of hedge fund liquid alternatives are equity strategies and multialternatives. Liquid alternatives are also available for macro and managed futures strategies, but typically not for event-driven and relative value strategies.
- Liquid alternatives typically have less risk and lower expected returns than private placements.

LO 21.6

- Market-defensive FOFs have a high mean return, very low volatility, and Sharpe ratio of 0.6. The return distribution exhibited skewness and excess kurtosis near zero and has slight positive correlation with world equities.
- Conservative FOFs have a low mean return, low volatility, and moderate Sharpe ratio of 0.3. They are positively correlated with major indices and exhibit little diversification benefits.
- Strategic and diversified FOFs have similar returns to their composite indices. Both FOFs have historical returns with modest mean returns, low volatility, and moderate Sharpe ratios of 0.2–0.3. Return distributions were moderately negative with positive kurtosis. They both have modest diversification benefits.

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Concept Checkers

1. A manager is considering how many hedge funds to include in constructing a well-diversified hedge fund across a number of different strategies. The manager assumes each individual hedge fund has an equal amount of systematic risk and a standard deviation of 30%. Under these assumptions, what is the estimated standard deviation of an equally weighted portfolio of 16 individual funds?
   A. 1.9%.
   B. 7.5%.
   C. 10.0%.
   D. 15.0%.

2. Which of the following is **NOT** related to a major advantage of multistrategy hedge funds over FOFs?
   A. Fees.
   B. Transparency.
   C. Manager selection.
   D. Tactical allocation.

3. Which of the following is **NOT** a reason that FOFs have less biased returns than individual hedge funds? FOFs use:
   A. the returns of liquidated funds in their track record.
   B. hedge fund returns from the date of the investment.
   C. actual investment weights.
   D. managers selected from a broader base.

4. Which of the following FOF categories had historical monthly performance that can be characterized as having a high mean return, low volatility, and the highest Sharpe ratio?
   A. Conservative FOFs.
   B. Diversified FOFs.
   C. Market-defensive FOFs.
   D. Strategic FOFs.

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Concept Checker Answers

1. **B** Theoretical approaches to estimating the impact of diversification are based on the assumption that all assets in the portfolio have equal weights, volatility, and amounts of systematic risk. Under these assumptions, the standard deviation of the portfolio is defined as:

   $\sigma_p = \frac{\sigma_f}{\sqrt{n}}$ = 0.30 / 4 = 0.075 or 7.5%. (LO 21.1)

2. **C** FOF managers have access to over 8,000 single-strategy fund managers to select managers from, whereas multistrategy fund managers typically have less than 50 to choose from. Manager selection is much more important for hedge funds than for traditional fund managers. (LO 21.1)

3. **D** The ability to select from a large number of managers does not impact biases in returns. FOFs retain the returns of liquidated funds in their track record. Survivor bias is present in broader indices when returns from dead funds are removed from or not included in the data. FOFs include hedge fund investment returns from the date of the investment and, therefore, reduce instant history bias. FOFs use actual weights that may be more reflective of investments in practice. (LO 21.3)

4. **C** The average monthly returns of market-defensive FOFs have a high mean return and low volatility that resulted in a Sharpe ratio of 0.6. (LO 21.6)

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The following is a review of the Private Equity principles designed to address the learning objectives set forth by the CAIA Association®.

Introduction to Private Equity

Topic 5.1

Exam Focus

This topic review outlines the basics of private equity investments, including the types of private equity, common private equity terminology, and the structure of private equity funds. In addition, candidates will also learn about private equity types, liquid alternatives, and the recent innovations found in the private equity market. In the two topic reviews that follow this review, an in-depth examination will be conducted of the four primary types of private equity.

Warm-Up: What is Private Equity?

Private equity typically refers to investment strategies that invest in privately traded (as opposed to publicly traded) equity, such as privately issued shares of stock or equity-linked issues of private companies. Private equity investors typically take on greater risk than their public equity counterparts but are more likely to achieve greater returns. The **call option view of private equity** refers to the usual losses and the unusual large gains from private equity investments that resemble those of an out-of-the-money call position. Successful private equity investors are willing to accept long-term investment horizons and conduct extensive due diligence. The four distinct investment types that fall within the scope of private equity include:

1. **Venture capital:** equity financing for start-up firms.

2. **Buyouts:** most commonly *leveraged buyouts* (LBOs); public firms that go private by repurchasing all outstanding public shares using borrowed capital.

3. **Mezzanine financing:** a blend of private debt and equity financing.

4. **Distressed debt investing:** private equity investments in already established firms that are troubled or distressed.

Professor's Note: The private equity category does contain some exceptions to the requirement that the securities be privately traded and in equity form. Therefore, the term private equity is somewhat a misnomer in that this category includes some forms of public securities and some debt securities.

The Structure of Private Equity

LO 22.1: Demonstrate knowledge of private equity terminology.

For example:
- **Recognize the structure of private equity funds and investments.**
- **Explain the roles of various entities involved in private equity investments.**

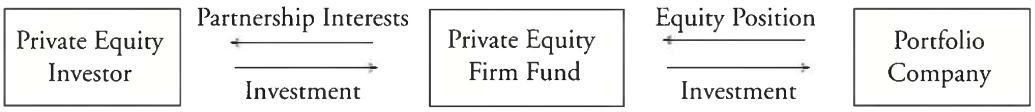
In the private equity structure, there are three levels: (1) private equity firms, (2) private equity funds, and (3) private equity portfolio companies. Unfortunately, the structure lends to some confusion because the term *private equity investment* may refer to an investment that takes place at any of the three levels. To clear up some of the confusion, we need to understand how the private equity market is structured.

Private equity firms are intermediaries that both raise funds and manage the investments of those funds. Private equity firms operate one or more private equity funds by serving as the fund's general partner. The limited partners of a private equity fund are institutional or wealthy investors and provide the majority of the capital for the fund. Note that limited partners are investing in the private equity fund rather than directly in the portfolio companies. Also, note that some private equity firms are investable themselves because their shares are publicly traded (e.g., Blackstone Group and Kohlberg Kravis Roberts).

The **limited partnership agreement** of the private equity fund defines the legal framework for the partnership and describes the terms and conditions for all parties involved with the fund. The life expectancy of the fund is typically 7 to 10 years with a possible extension of up to three years. Shares of the fund (also known as *limited partnership interests*) are not registered with the Securities and Exchange Commission (SEC), so they cannot be traded on public exchanges.

A **private equity fund** invests in **underlying business enterprises** (also known as *portfolio companies* or *private equity securities*). The following diagram may help you understand the private equity investment process.

Figure 1: The Typical Private Equity Investment Transaction



Returns for the private equity sector may vary widely depending on the vintage year. The **vintage year** refers to the calendar year that a private equity fund was established and the first drawdown of capital was made. As a result, some funds attempt to engage in market timing by only investing in certain vintage years expected to outperform while avoiding years with poor return expectations. Other funds find that engaging in a cost averaging strategy (i.e., consistently investing in each vintage year) provides superior returns due to the diversification of vintage years.

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Evolution of the Private Equity Market

As the private equity market matures and grows in size, it has become much more efficient. This can be attributed to increased competition. Traditionally, a single private equity firm would approach a company with an idea for a deal (i.e., a deal-driven market). The deal may involve taking a public company private or having a parent company spin off a subsidiary. The single private equity firm would build a long-term relationship with company management and work on the deal without competitive bidding from other firms. Today's private equity market creates competition between private equity firms through a bidding process organized by an investment banker. The increased competition has led to declining profits for private equity firms and has forced some firms to seek new deal structures or to expand into other investment types, such as hedge funds.

Equity Security Forms of Private Equity

LO 22.2: Demonstrate knowledge of the major forms of private equity investments that involve direct ownership of equity claims.

For example:
- **Recognize characteristics of venture capital and its role in business start-ups.**
- **Discuss the prudent person standard in the context of venture capital.**
- **Recognize characteristics of buyouts and the role of debt in these transactions.**
- **Recognize characteristics of merchant banking and the benefits it offers financial institutions.**

Both venture capital and buyouts are classified as equity forms of financing. That is, both of these forms of private equity represent ownership stakes in the underlying portfolio companies.

Venture Capital

Venture capital involves senior equity investments in start-up ventures that are unable to attract capital from more traditional sources such as banks. Often there are insufficient tangible assets to collateralize traditional bank loans. In addition, start-ups generally have negative cash flow for the first few years, discouraging traditional funding sources. The **burn rate** is the rate in which cash is spent over time and can be used to determine when the start-up will need additional financing.

Venture capitalists are in the business of financing these types of entities (immature, cash flow negative firms). They are willing to take significant risks, and lose their entire investment in several ventures, in the hopes of cashing in on a few highly profitable ventures by taking equity stakes in the firms in which they invest. Venture capital funds not only bring money to the ventures, but also bring relevant expertise, contacts, and strategic advice. Managers of venture capital funds often take a very active role in portfolio companies through board or daily management participation. The managers purchase venture capital securities as their form of investment. **Venture capital securities** are illiquid equity investments, and investors often have to commit capital for 5 to 10 years before they can cash out (i.e., exit) their investment. Proper exit strategies are critical to ensure the eventual realization of value. Venture capitalists wish to be compensated in stock or equity-linked securities so ownership stakes can easily be sold in the event of an initial public offering.

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History of Venture Capital and the Prudent Person Standard

The first venture capital firm, *American Research and Development*, was formed in 1946 as a publicly traded, closed-end fund. In 1958, the first venture capital limited partnership was formed, *Draper, Gaither & Anderson*. Venture capital limited partnerships were closed-end funds managed by a general partner and funded by several limited partners without management responsibilities. The popularity of the limited partnership concept eventually allowed it to become the predominant structure for venture capital.

The venture capital industry was further boosted in 1979, when guidelines related to pension funds were amended to permit pension funds to invest in venture capital, opening up a significant source of capital for venture capital firms. Specifically, the **prudent person standard**, which defines the fiduciary responsibilities of trustees, was changed to allow venture capital investments if the investments are deemed to be prudent in the context of an entire portfolio of assets. Prior to this, venture capital investments were deemed too risky because they were evaluated on a stand-alone basis. In addition, the new standard called for investment suitability to be judged on a pre-investment basis, rather than on the actual investment outcome. Thus, if pension managers conduct adequate due diligence on potential venture capital funds and keep overall portfolio risks at an acceptable level, they may include venture capital in their portfolio allocation.

Buyouts

A buyout is an investment structure designed for an investor or group of investors to take a public company private by purchasing all outstanding stock using a large quantity of borrowed capital (e.g., as much as 90% of the total deal may be in the form of debt). Buyouts are typically financed by using the firm's assets and cash flows to secure debt financing (bonds and/or bank loans). Like other forms of private equity investing, buyouts are long-term in nature and illiquid. When the investor or group of investors is the firm's current management team, the transaction is referred to as a management buyout (MBO). After an MBO, control shifts to the buyout firm and the target's management. In both a buyout and an MBO, public shares are eliminated.

Goals of Buyout Transactions

When a company has struggled for an extended period of time, an acquirer may believe it can pay a lower price to buy the company and unlock hidden value by taking the following actions:

- Expand the balance sheet capacity of the firm (i.e., use more debt).
- Actively manage the firm.
- Replace the management team with professional managers.
- Use debt to realize tax advantages.
- Refocus the firm's business plan towards value creation.
- Align management's interests with shareholders' interests.

The History of Buyouts

Several key historical events have influenced the development of the buyout industry, including the following:

1960s: In the years following World War II, the first buyouts are created.

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1960s: Bear Stearns conducts several buyouts.

1976: Kohlberg Kravis Roberts & Co. (KKR) was founded by three former Bear Stearns employees who had specialized in buyout creation. KKR was a leading innovator in the buyout market throughout the 1970s and 1980s.

1980s: Junk bonds (subordinated, high-yield bonds that are below investment grade) grew in popularity and become a key element of buyouts. In the mid-1980s, Michael Milken was a powerful player in this market through his firm, Drexel Burnham Lambert.

1989: At the height of the buyout boom, KKR bought RJR Nabisco for $31 billion. This event increased the awareness of buyouts and was chronicled in the book *Barbarians at the Gate*.

1990s: Buyout transactions declined for two reasons: (1) the United States was in recession in 1990–91, and (2) in 1998, the Russian government defaulted on its Treasury bonds. The market changed—LBO deals with debt loads (the debt proportion of the LBO financing) above 75% were deemed unattractive, while they had been as high as 95% in the 1980s.

2000s: The burst of the tech bubble and the recession that followed slowed buyout growth in the early 2000s.

2003–2007: Low interest rates boosted buyout activity and led to the record buyout of TXU for $32 billion in 2006 by KKR.

2008: The credit crisis of 2008 led to a steep decline in buyout activity.

Segmentation in the early days of buyouts was common. **Segmentation** refers to instances where market participants are specialists that only operate in specific market segments. This segmentation allowed inefficiencies to persist in the buyout market such that market prices failed to equal fair value prices. Today, the buyout market has evolved into an efficient auction market.

Merchant Banking

Merchant banking is the purchase of nonfinancial firms by financial institutions. Merchant banking deals are quite similar in structure to buyout firms. However, for merchant banking deals, the financial institution (i.e., the merchant bank) is always the general partner. Many large investment banks have merchant banking divisions, which is a way for financial institutions to participate in the upside of firms they finance. Merchant banking benefits investment banks because it allows them to earn additional fees by providing loans, underwriting services, business advice, and recapitalization services (i.e., reducing the firm's equity and increasing its leverage). Some investment banks have now increased their merchant banking divisions to the point that they operate their own buyout funds and actively seek buyout deals.

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Debt Security Forms of Private Equity

LO 22.3: Demonstrate knowledge of the major forms of private equity that involve direct ownership of debt securities.

For example:
- **Describe mezzanine debt, and explain why it is considered a type of private equity investment.**
- **Describe distressed debt securities in the context of private equity investing.**
- **Discuss the growth of the distressed debt marketplace.**
- **Explain various types of debt covenants.**
- **Describe leveraged loans in the context of private equity investing.**
- **Discuss the growth of leveraged loans.**

Mezzanine debt and distressed debt would be classified as debt forms of financing. That is, both forms of private equity represent debt claims on the underlying portfolio companies. In addition, leveraged loans are becoming an increasingly popular investment vehicle in the private equity marketplace.

Mezzanine Debt

Mezzanine debt (or *mezzanine financing*) is a hybrid of debt and equity and falls between senior secured debt and equity in a company's capital structure. The typical form of mezzanine debt is an intermediate term bond with an equity kicker. The **equity kicker** may take the form of options, warrants, or some conversion feature. The bond or note may have payment in cash or *payment in kind* (PIK), whereby the debt is repaid with additional debt. Mezzanine debt may take the form of senior subordinated debt, convertible subordinated stock, or convertible preferred stock.

Mezzanine financing is used to bridge financing gaps as a firm grows and evolves. Those gaps include gaps in time (e.g., a private firm has exhausted its initial venture capital but is trying to get to the IPO stage), gaps in capital structure (e.g., mezzanine debt provides debt financing beyond what secured lenders are willing to lend but without significantly diluting the firm's outstanding equity holders), and financing gaps in a buyout deal (e.g., mezzanine financing may be used to complete financing of a buyout deal).

Mezzanine financing falls somewhere between junk bonds and story credits. **Story credits** are loans to a company with a good story and an atypical situation, rather than a strong credit history. Typically, story credits are in the form of senior secured debt. Mezzanine debt fills the gap in capital markets for financing available to middle market companies (i.e., firms with a market capitalization of $200 million to $2 billion). High-yield bonds and leveraged loans are generally only available to large public companies, while small companies tend to rely on venture capital. Middle market companies tend to use levels of mezzanine financing in the range of $5 to $50 million. Mezzanine debt structures are customized and negotiated between counterparties, making them considerably more illiquid than the high-yield bonds and leveraged loans available to larger companies.

Distressed Debt

Distressed debt refers to debt securities issued by companies that are in financial hardship. *Financial hardship* may refer to firms that are in default, firms that are about to default, or

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firms that have filed for bankruptcy protection. Distressed debt investors, sometimes called vultures, buy the debt of these financially troubled firms and then seek rapid improvement of the firm. The objective is to profit as the company becomes more stable and the value of its debt rises or to cheaply gain an equity stake in the company if it slips into bankruptcy.

The term *distressed debt* has two primary meanings:

1. The issuer of the debt is in financial trouble. For example, the issuer may have recently become behind or defaulted on its debt.

2. The price of the debt is distressed and is selling for a fraction of face value (e.g., 50 cents on the dollar).

Distressed debt strategies have two primary sources of risk: business risk and liquidity risk.

Note that the performance of the overall economy is not a primary concern for distressed debt investors because they are more concerned with company-specific issues. However, poor market conditions can increase the size of the distressed debt market as an increased level of debt becomes distressed.

Furthermore, the term *distressed debt* lacks precision in that there is no universal definition of what debt should be classified as distressed. However, in general terms, distressed debt usually meets one or more of the following criteria:

- Credit rating of debt issue, if available, is equal or lower than CCC (S&P) or Caa (Moody's). This low rating indicates that no interest is being paid and/or the issuer is in default.
- The current market value of the debt issue is lower than 50% of its principal.
- The yield to maturity for the debt issue is at least 10% higher than the current risk-free rate.

Growth of Distressed Debt

The market for distressed debt investments grew substantially since 2000. Why did this segment of the private equity experience such growth during this period? There are at least five factors that contributed to the increase, including:

1. *New types of commercial loans.* There was an expansion in the number and types of commercial loans being resold, including new types of charge-off loan portfolios, which included healthcare receivables, auto deficiencies, and other debts. **Charge-off loans** are bad debts that have been deemed uncollectible by a creditor and are, therefore, written off as a loss. The debt is then sold to investors as distressed debt.

2. *Active portfolio management.* Banks and other lenders used risk management techniques to maintain a specific risk-return balance. Such strategies called for selling nonperforming or subperforming assets to make the loan portfolio look better.

3. *Increased debt levels.* The level of debt, including commercial loans, industrial loans, residential mortgages, and installment credit, rapidly increased during this period. Some of this debt was low quality and became distressed debt.

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4. *Increased level of mergers, acquisitions, and buyouts.* Some mergers, acquisitions, and buyouts fail, leaving target firms distressed. With growth in merger and acquisition activities comes growth in the number of distressed firms and consequently more distressed debt. When debt becomes impaired, the holder of the debt may need to take a haircut on its debt holdings. The **haircut** (or margin) refers to the reduction in value from a security's purchase price to its current price. For example, a bond that was originally purchased at $1,000 but is now valued at $400 has experienced a 60% haircut.

5. *Growth of covenant-lite loans.* Covenants are the terms and conditions the borrowing and lending parties have agreed to as part of the bond issue. They include restrictions on management's ability to make operating and financial decisions in the normal course of business. There are two general types of covenants: positive covenants and negative covenants. **Positive covenants** require the debtor to take certain actions, such as paying interest, principal, and taxes, complying with loan agreements, and maintaining properties. **Negative covenants** prohibit the borrower from taking certain actions. They place limitations on the borrower's ability to incur additional debt, maintain sufficient coverage of interest expenses and other fixed charges, place restrictions on borrowings by subsidiaries, maintain certain levels of cash flow and working capital, and place limitations on dividend payments and stock repurchases.

   Covenant-lite loans, as the name implies, are debtor-friendly leveraged loans lent with fewer covenant protections for the lender. With fewer covenants on the borrower, the loans are more likely to default. An example of reduced covenant protection would be the use of incurrence covenants in place of maintenance covenants. Under an **incurrence covenant**, the company must meet any specified criteria (e.g., a debt-to-earnings ratio lower than 4.0) when a specified action is taken, such as issuing new debt. Therefore, a firm can violate the specified criteria as long as the violation is not a direct result of taking the actions specified in the covenant. Under a **maintenance covenant**, the company must meet any specified criteria on a regular basis and failure to meet the specified criteria is a violation of the covenant regardless of the reason for the violation. Maintenance covenants are considerably stronger than incurrence covenants.

Leveraged Loans

Since private equity firms have a great deal of experience seeking high-yield financing and dealing with fixed income investors, they have become highly influential in the market for leveraged loans. **Leveraged loans** are loans made to borrowers who do *not* carry an investment grade credit rating. A loan to a speculative grade borrower is considered *leveraged* because the borrower typically has a large amount of leverage on its balance sheet. Leveraged loans are typically considered an absolute return product, which has helped the growth rate of leveraged loan issuance. Much like distressed debt, a leveraged loan does not have an accepted definition. However, a leveraged loan typically meets at least one of the following conditions:

- The borrower's debt carries a noninvestment grade credit rating, which is defined as a rating lower than BBB from S&P or lower than Baa from Moody's.
- The loan carries a spread greater than 125 basis points over the London Interbank Offered Rate (LIBOR).
- The loan is subordinated to other senior secured loans (also known as a *second lien loan*).

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Loan **syndication**, where several lenders provide various parts of a large loan, which is administered by one or more commercial or investment banks, is becoming a regular characteristic of leveraged loans.

Secondary Market for Leveraged Loans

Prior to the 1990s, the leveraged loan market was small and was primarily made up of banks that made loans to corporate borrowers. However, since the mid-1990s, institutional investors have played an increasingly greater role as they have used bank loans as a means to achieve a more consistent yield in their fixed-income portfolios. The rapid growth of the leveraged loan market can be largely attributed to the establishment of a well-functioning secondary market. This secondary market became much more useful in 1995 when Moody's decided to begin giving credit ratings to bank loans. This action increased market liquidity, which in turn increased investors' interest in the market. This increase in popularity has caused the leveraged loan market to overtake the high-yield bond market in terms of size.

Liquid Alternatives in Private Equity

LO 22.4: Demonstrate knowledge of liquid alternatives in the private equity sector.

For example:
- **Describe business development companies (BDCs).**
- **Calculate the premium (or discount) of closed-end fund prices.**
- **Recognize the effect of illiquidity on closed-end fund pricing.**
- **Discuss the diversification and return-enhancement potential of liquid private equity pools.**
- **Discuss other liquid investments in private equity.**

Business Development Companies

Business development companies (BDCs) operate as publicly traded funds that usually invest in the equity of small- to medium-sized private entities. BDCs are structured as closed-end funds, and they pool large amounts of financial assets. Investors are entitled to a pro-rata share of those assets.

One key benefit of BDCs is the ability to bypass corporate income tax, thereby only subjecting the shareholders to one level of taxation, the personal tax on the distributed profits. As a result, it is optimal to distribute most of the profits in order to eliminate corporate tax on any profits retained within the BDC. However, access to such a tax benefit requires the BDC to provide considerable management services to the entities it invests in and a minimum of 70% of the investments must be in *eligible assets* per the SEC.

An easy way to think about BDCs is to compare them to real estate investment trusts (REITs). REITs provide liquidity for otherwise illiquid real estate assets, similar to how BDCs provide liquidity for otherwise illiquid private equity.

Calculating Premiums or Discounts on Closed-End Funds

BDCs are structured as closed-end funds whereby the underlying fund assets are reflected as pro-rata ownership by investors in the form of shares. Closed-end structures allow for the

ownership of illiquid assets in a relatively liquid form. Closed-end fund prices are compared to the net asset value (NAV) per share. Therefore, the funds will often trade at a premium or discount to NAV. As seen in the equation below, premiums are positive and discounts are negative:

premium (discount) as a percentage of NAV = (market price / NAV) – 1

Illiquidity Effects on Closed-End Fund Pricing

When there is significant illiquidity in the market, (e.g., during a financial crisis), closed-end funds have historically been subject to extreme pricing discounts. The negative impact to BDC investors selling their investments during such a time is amplified due to the low NAV due to market decline and the extreme discount reflected in the market price of the fund compared to its NAV. Furthermore, many BDCs have underlying assets that are not listed, so the NAVs are reported using non-market valuations instead of current market prices. As a result, the calculated premiums or discounts may be inaccurate because the NAVs are also inaccurate.

Liquid Private Equity Pools

The empirical evidence (based on repeated studies over differing time periods) suggests that listed BDCs exhibit return patterns that are highly correlated to listed equities. As a result, there is little or no diversification benefit by adding investments in listed BDCs to an existing portfolio of listed equities.

In terms of return-enhancement potential, a cost-benefit analysis needs to be performed. Consider the BDCs, which is an ETF that tracks the U.S. BDC sector. From a cost perspective, there are ETF fees as well as a much higher expense ratio compared to other ETFs. Additionally, the underlying BDCs could have high expense ratios. From a benefit perspective, there is the quality of the management teams. Therefore, if the BDCs can provide management services that generate returns in excess of the costs discussed, then there is return-enhancement potential.

Other Liquid Investments in Private Equity

Investments in publicly traded shares of private equity asset management companies (e.g., Blackstone Group) may provide indirect exposure to private equity returns. The carried interest earned by the companies for their underlying private equity management services serves as the source of return to the investors.

Furthermore, investments in listed companies (e.g., Onex) that invest in many private companies provide investors with direct exposure to private equity returns.

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Trends and Innovations in Private Equity

LO 22.5: Demonstrate knowledge of trends and innovations in private equity markets.

For example:
- **Discuss secondary markets in the context of private equity.**
- **Explain private investment in public equity (PIPE) transactions, and compare it to other private equity investments.**
- **Recognize advantages that PIPEs offer investors.**
- **Recognize and compare various types of PIPEs.**
- **Discuss hedge fund participation in private equity.**
- **Contrast private equity funds and hedge funds.**

Innovations in private equity in the last 30 years include the secondary market for private equity, the creation of private investment in public equity (PIPE) instruments, and the increasing prevalence of hedge fund activity in the private equity market.

A Secondary Market for Private Equity

As we just mentioned with regard to leveraged loans, the presence of an active secondary market plays a substantial role in the popularity of an investment vehicle. The presence of an active secondary market helps alleviate some of the liquidity risk associated with private equity. This is quite important because private equity investors occasionally need to exit an investment earlier than expected.

Cases where a private equity investor may need to sell a portion of their private equity investment in the secondary market include portfolio rebalancing, risk reduction, and the need to generate cash for near-term cash distributions. Keep in mind that those cases are more related to the changing needs of the investor, rather than a drastic change in the value of its private equity portfolio.

Advantages of a secondary market to buyers of private equity limited partnerships include:

- *Greater access to future private equity funds.* An investor purchasing a secondary deal from a limited partner who wants to exit the deal may generate goodwill that puts the investor first on the list for future deals.
- *More effective vintage year diversification.* A secondary market allows a private equity investor to purchase portions of multiple deals, which allows for greater diversification within a private equity allocation.
- *Faster profit realization.* By purchasing a later stage private equity deal, the investor may be able to realize positive returns more quickly.
- *Opportunistic buying.* In some cases, investors may find more attractive investment opportunities in the secondary market for private equity than they find in the primary market.

However, investors who choose to act as sellers in the secondary marketplace are very unlikely to receive an invitation to invest in future funds run by the general partner of the fund. Therefore, investors should also consider the future lost investment opportunities before selling a private equity interest in the secondary market.

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Private Investments in Public Equity

With a **private investment in public equity (PIPE)** transaction, an investor group deals directly with a public firm to acquire a private equity position. PIPE transactions are effectively private placements since the public firms sell unregistered securities to institutional investors. These securities cannot be resold until they are registered with the SEC. The advantage to the investors, such as private equity firms, is that the stock is often sold at a sizeable discount to its market price. However, the issuing company generally seeks registration of the securities after the private placement is made. It is often the case that the shares are sold with a commitment to register within six months, giving the investor an exit strategy.

The four major types of PIPEs and their advantages to investors are as follows:

1. *Registered common stock*—issued privately to a limited set of investors under an existing registration with the SEC. Typically only sold at a small discount to the public shares.

2. *Privately placed common stock*—unregistered shares that are not tradable in public markets. Sold at a significant discount to public shares.

3. *Convertible preferred stock or convertible debt*—unregistered private placement of convertible securities. Offers flexibility to the issuer and a significant discount to the investor, who also obtains seniority to common shareholders. The issuer generally agrees to register the securities six months after the close of the offering.

4. *Equity line of credit*—the issuer agrees to sell a specified number of registered shares to the investor at regular intervals (e.g., semiannually).

The discount associated with PIPEs is the key reason private equity firms are interested in this market. In the public market, private equity firms often are forced to pay a premium if they want to acquire a sizeable share of a company.

The primary reason for public firms to engage in PIPE transactions is they are less costly and can be done relatively quickly (e.g., several weeks) compared to public offerings, which take considerably longer and are much more expensive.

Traditional vs. Structured PIPEs

In a **traditional PIPE** transaction, the issuer privately sells convertible debt or convertible preferred stock with a *fixed* common equity conversion ratio. The **conversion ratio** is the number of common shares for which a convertible security can be exchanged. For example, a convertible bond issued at par with a conversion ratio of 10 allows its holder to convert one $1,000 bond into 10 shares of common stock. Therefore, the **conversion price** of a par bond is $1,000 / 10 shares = $100. For bonds not issued at par, the conversion price is the issue price divided by the conversion ratio. Note that the fixed conversion ratio offers existing equity investors some protection as it prevents substantial equity dilution in the event of a stock price decline.

A less straightforward way to issue private equity is through a **structured PIPE**, in which floating convertibles, reset convertibles, reset common equity, or reset convertible preferred stock are issued. Structured PIPEs vary in their terms but generally are ambiguous in the amount of common equity that gets issued due to the *floating* equity conversion ratios

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within the PIPE securities. The number of shares received by the PIPE investor increases as the price of the common stock decreases.

A **toxic PIPE** situation occurs when a structured PIPE receives greater and greater amounts of common equity as the price of the issuer's stock falls. This creates a **death spiral** for a company issuing a PIPE since the price of the issuer's outstanding, publicly traded common stock tends to decline after the PIPE is issued. The death spiral is made worse by investors who short the issuer's stock, putting further downward pressure on the price. As the stock price is forced down, the conversion ratio increases, causing further dilution of existing owners' percentage ownership claims and further declines in the stock price. This process continues until the issuer's stock price is severely depressed. At the end of the death spiral, PIPE investors earn large profits by converting their PIPE securities to common equity at a discount and covering their short positions. Alternatively, the PIPE investors effectively take control of the company through their majority equity ownership.

It is important to realize that companies may issue structured PIPEs because their financial situation has deteriorated to the point that investors are uninterested in other investment types of financing (e.g., equity, debt, or traditional PIPEs). To help prevent structured PIPEs from becoming toxic PIPEs, the floating conversion ratios should contain floor provisions. The price floor restricts conversions below a certain price or limits the conversion ratio (i.e., creates a conversion ratio ceiling), preventing an unending increase in the conversion ratio.

Hedge Funds and Private Equity

Private equity firms have experienced greater competition from hedge funds when it comes to bidding on corporate assets, especially since the 2007 financial crisis. The increased interest by hedge funds can be attributed to the desire for diversification and the firm's desire to use the full skill set of its employees and software.

Compared to private equity firms, hedge funds have much more favorable deal terms and fee structures, giving them advantages in the bidding process. These advantages have led many private equity firms to create their own hedge funds to bid on deals. The deal term advantages for hedge funds over private equity firms include the following:

- Hedge fund incentive fees are based on changes in net asset value (NAV), while private equity fund incentive fees are based on realized profits.
- Hedge funds typically do not have provisions for the clawback of management or incentive fees, while private equity funds do.
- Hedge funds that specify a hurdle rate typically target a hurdle rate in excess of cash (e.g., LIBOR + 5%), while private equity firms try to achieve returns of greater than 20%. Having a lower hurdle rate encourages hedge fund managers to be more aggressive in the bidding process and means that hedge fund managers are more likely to receive incentive fees.
- Hedge fund managers receive incentive fees earlier than private equity managers do. This is because private equity incentive fees are paid only upon exit of a portfolio company, while hedge fund incentive fees are often front-loaded.
- Hedge fund incentive fees are collected on a regular basis (e.g., annually), while private equity fees are only collected after exiting investments.
- Hedge funds can receive incentive fees at any time, while private equity funds receive incentive fees only after returning capital to investors (e.g., investment exit or at the end of the fund's life).

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Key Concepts

LO 22.1

Private equity firms are intermediaries who both raise funds and manage the investments of these funds. A private equity fund invests in private equity portfolio companies (a.k.a. private equity securities and underlying business enterprises), which are investments in underlying business enterprises.

The limited partnership agreement of the private equity fund defines the legal framework for the partnership. The life expectancy of the fund is typically 7 to 10 years with a possible extension of up to three years. Private equity fund shares (also known as limited partnership interests) are not registered with the SEC, so they cannot be traded on public exchanges.

LO 22.2

Venture capital involves senior equity investments in start-up ventures that are unable to attract capital from more traditional sources often due to their negative cash flows. Venture capitalists raise funds and invest in these start-up firms. Venture capitalists take an active role in the venture's strategy and management. Venture capital investments are illiquid, and investors often have to commit capital for 5 to 10 years. Proper exit strategies are critical to ensure the eventual realization of value.

In 1979, the prudent person standard, which defines the fiduciary responsibilities of trustees, was changed to allow venture capital investments if the investments are deemed to be prudent in the context of an entire portfolio of assets. In addition, the new standard called for investment suitability to be judged on a pre-investment basis, rather than on the actual investment outcome.

A buyout is an investment structure designed to take a public company private by purchasing all outstanding stock using a large quantity of borrowed capital. Buyouts are typically financed by using the firm's assets and cash flows to secure debt financing and are termed leveraged buyouts if substantial debt is used. Buyouts are long-term in nature and illiquid. When the investor or group of investors is the firm's current management team, the transaction is referred to as a management buyout (MBO). After a buyout, control shifts to the buyout firm and management. Public shares are eliminated.

Merchant banking is the purchase of nonfinancial firms by financial institutions. Merchant banking deals are quite similar in structure to buyouts. However, for merchant banking deals, the financial institution (i.e., the merchant bank) is always the general partner. Merchant banking benefits investment banks because it allows them to earn additional fees by providing loans, underwriting services, business advice, and recapitalization services.

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LO 22.3

Mezzanine debt is a hybrid of debt and equity and falls between senior secured debt and equity in a company's capital structure. The typical form of mezzanine debt is an intermediate term bond with an equity kicker. The bond or note may have payment in cash or payment in kind (PIK), whereby the debt is repaid with additional debt.

Mezzanine financing is used to bridge financing gaps as a firm grows and evolves. These gaps include gaps in time (e.g., a private firm has exhausted its initial venture capital but is trying to get to the IPO stage), in capital structure (e.g., mezzanine debt provides debt financing beyond what secured lenders are willing to lend but without significantly diluting the firm's outstanding equity holders), and in a buyout deal (mezzanine financing may be used to complete financing of a buyout deal). Mezzanine debt fills the gap in capital markets for financing available to middle market companies (i.e., firms with a market capitalization of $200 million to $2 billion).

Distressed debt refers to debt securities issued by companies that are in financial hardship. Financial hardship may refer to firms that are in default, firms that are about to default, or firms that have filed for bankruptcy protection. The objective is to profit as the company becomes more stable and the value of its debt rises or to cheaply gain an equity stake in the company if it slips into bankruptcy. Distressed debt strategies have two primary sources of risk: business risk and liquidity risk. Distressed debt usually meets one or more of the following criteria:

- Credit rating of debt issue, if available, is equal or lower than CCC (S&P) or Caa (Moody's).
- The current market value of the debt issue is lower than 50% of its principal.
- The yield to maturity for the debt issue is at least 10% higher than the current risk-free rate.

The market for distressed debt investments grew substantially since 2000 due to the following reasons:

- New types and increased issuance of commercial loans.
- Active portfolio management by lenders.
- Increased debt levels.
- Increased level of mergers, acquisitions, and buyouts.
- Growth of covenant-lite loans.

Covenants are the terms and conditions the borrowing and lending parties have agreed to as part of the bond issue.

- Positive covenants require the debtor to take certain actions.
- Negative covenants prohibit the borrower from taking certain actions.
- Incurrence covenants specify criteria that must be met only when a specified action is taken, such as issuing new debt.
- Maintenance covenants specify criteria that must be met on a regular basis. Failure to meet the specified criteria is a violation of the covenant regardless of the reason for the violation.

Leveraged loans are loans made to borrowers who do not carry an investment grade credit rating. Leveraged loans refer to loans that are made to borrowers that have a coupon rate greater than LIBOR + 125 bps and are subordinated to other senior secured loans. Loan syndication, where several lenders provide various parts of a large loan, which is

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administered by one or more commercial or investment bank, is becoming a regular characteristic of leveraged loans.

The rapid growth of the leveraged loan market can be largely attributed to the establishment of a well-functioning secondary market. This secondary market became much more useful in 1995 when Moody's decided to begin giving credit ratings to bank loans. This action increased market liquidity, which in turn increased investor's interest in the market. This increase in popularity has caused the leveraged loan market to overtake the high-yield bond market in terms of size.

LO 22.4

Business development companies (BDCs) operate as publicly traded funds, invest in the equity of small- to medium-sized private entities, and are structured as closed-end funds. BDCs can avoid corporate income tax by fully distributing profits to its shareholders.

For closed-end fund prices, the premium (discount) is calculated as:

premium (discount) as a percentage of NAV = (market price / NAV) – 1

In the presence of significant illiquidity in the market, closed-end funds have historically been subject to extreme pricing discounts. The negative impact to BDC investors selling their investments during such a time is amplified due to low NAV due to market decline and the extreme discount reflected in the market price of the fund compared to its NAV.

Listed BDCs typically exhibit return patterns that are highly correlated to listed equities, thereby resulting in little or no diversification benefit by adding investments in listed BDCs to an existing portfolio of listed equities.

There is return-enhancement potential as long as the BDCs can provide management services that generate returns in excess of the costs incurred.

Investments in publicly traded shares of private equity asset management companies and investments in listed companies that invest in many private companies are two other types of investments in private equity.

LO 22.5

Advantages of a secondary market to buyers include the following:

- Greater access to future private equity funds.
- More effective vintage year diversification.
- Faster profit realization.
- Opportunistic buying.

With a private investment in public equity (PIPE) transaction, an investor group deals directly with a public firm to acquire a private equity position. The discount associated with PIPEs is the key reason private equity firms are interested in this market. In the public market, private equity firms often are forced to pay a premium if they want to acquire a sizeable share of a company. The primary reason for public firms to engage in PIPE

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transactions is they are less costly and can be done relatively quickly (e.g., several weeks) compared to public offerings, which take considerably longer and are much more expensive.

- In a traditional PIPE transaction, the issuer privately sells convertible debt or convertible preferred stock with a fixed common equity conversion ratio.
- In a structured PIPE transaction, the issuer privately sells convertible debt or convertible preferred stock with a floating common equity conversion ratio.
- A toxic PIPE situation occurs when a structured PIPE receives greater and greater amounts of common equity as the price of the issuer's stock falls. This creates a death spiral for a company issuing a PIPE since the price of the issuer's outstanding, publicly traded common stock tends to decline after the PIPE is issued.

Deal term advantages for hedge funds over private equity firms include the following:

- Hedge fund incentive fees are based on changes in net asset value (NAV), while private equity fund incentive fees are based on realized profits.
- Hedge funds typically do not have provisions for the clawback of management or incentive fees, while private equity funds do.
- Hedge funds typically target a hurdle rate in excess of cash (e.g., LIBOR + 5%), while private equity firms try to achieve returns of greater than 20%.
- Hedge fund managers receive incentive fees earlier than private equity managers do.
- Hedge fund incentive fees are collected on a regular basis, while private equity fees are only collected after exiting investments.
- Hedge funds can receive incentive fees at any time, while private equity funds receive incentive fees only after returning capital to investors.

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Concept Checkers

1. Which of the following statements concerning private equity is **FALSE**?
   A. Private equity firms play the role of general partners of private equity funds.
   B. A private equity fund's vintage year is calculated as the weighted-average vintage year of the private equity securities in which it invests.
   C. Institutional investors prefer to indirectly invest in underlying business enterprises by becoming limited partners in a private equity fund.
   D. While shares of private equity funds are not publicly traded, shares of some private equity fund management firms are publicly traded.

2. Which of the following is an example of a positive covenant? The company:
   A. must maintain a times interest earned ratio of at least two times.
   B. must not use the same collateral to back more than one debt obligation.
   C. may not sell fixed assets that have been pledged as collateral for the bonds.
   D. cannot borrow any additional money unless the new debt is subordinated to the current debt.

3. Which of the following statements regarding secondary trading in the private equity market is **TRUE**?
   A. Secondary trading generally causes investors to have to wait over a longer time period to generate returns from their private equity investment.
   B. Secondary trading makes it more difficult for investors to make strategic shifts in the private equity allocations within their portfolios.
   C. Secondary markets are a form of distressed securities markets wherein limited partners sell securities with troubled performance histories.
   D. A trade in a secondary market may be motivated by the desire for increased access to deals in the primary market.

4. Which of the following statements regarding the history of buyouts is *most accurate*?
   A. Kohlberg Kravis Roberts & Co. (KKR) led the two largest buyouts in history.
   B. The current buyout market is best described as segmented due to the limited number of participants and their limited area of focus.
   C. Buyout activity increased in the 1990s as the U.S. recession and Russian sovereign default led to an increased level of buying opportunities.
   D. Buyout activity increased in 2007–2008 as the credit crisis led to an increased level of buying opportunities.

5. Which of the following is **NOT** an advantage for a hedge fund over a private equity firm when defining terms for a private equity deal?
   A. Hedge funds can receive incentive fees before returning capital to investors.
   B. A hedge fund does not need to recoup management fees before paying incentive fees.
   C. Private equity incentive fees are based on realized profits, while hedge fund incentive fees are based on changes in net asset value (NAV).
   D. Hedge funds have a higher return hurdle rate than private equity firms.

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6. The increasing role of private equity firms in the leveraged loan market *most likely* reflects a(n):
   A. extension of the private equity firms' existing financing business.
   B. desire for an investment with low levels of idiosyncratic risk.
   C. desire for exposure to higher credit quality assets.
   D. means to more effectively manage credit risk.

7. Which of the following statements *best* describes how a toxic private investment in public equity (PIPE) can occur when a floating conversion ratio is used and also describes a way to prevent toxic PIPEs?
   A. Investors short the issuer's stock, forcing the price down so they earn large profits by covering the short position with cheap stock. This action causes a death spiral that can be prevented with traditional PIPEs.
   B. Investors purchase the issuer's stock, driving the equity conversion ratio up so they can take control of the issuer. This action causes a death spiral that can be prevented with structured PIPEs.
   C. Investors short the issuer's stock, driving the equity conversion ratio down so they can take control of the issuer. This action causes a death spiral that can be prevented with traditional PIPEs.
   D. Investors short the issuer's stock, forcing the price down to earn large profits by covering the short position with cheap stock. This action causes a death spiral that can be prevented with structured PIPEs.

8. The shares of a closed-end fund, Andrigo, are selling at $45, while Andrigo's net asset value (NAV) is $40. Which of the following statements is *most accurate*? The shares are trading at:
   A. an 11.1% discount to NAV.
   B. an 11.1% premium to NAV.
   C. a 12.5% discount to NAV.
   D. a 12.5% premium to NAV.

9. Which of the following statements regarding business development companies (BDCs) and private equity investments is *most accurate*?
   A. The ETF that tracks the U.S. BDC sector has a much higher expense ratio compared to other ETFs.
   B. BDCs are subject to two levels of taxation, corporate to the company and then personal to the profit distributions to the shareholders.
   C. Studies suggest that there is moderate diversification benefit by adding investments in listed BDCs to an existing portfolio of listed equities.
   D. Investments in publicly traded shares of private equity asset management companies provide investors with direct exposure to private equity returns.

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Concept Checker Answers

1. **B** The vintage year refers to the calendar year that a private equity fund was established and the first drawdown of capital was made. No calculations regarding the age of the underlying portfolio holdings are necessary. The other choices are all correct statements regarding private equity. (LO 22.1)

2. **A** Covenants are the terms and conditions the borrowing and lending parties have agreed to as part of the bond issue. Positive covenants specify what the company must do. Negative covenants specify what they must not do. All other answer choices are examples of negative covenants. (LO 22.3)

3. **D** One of the advantages to secondary trading is that making secondary purchases can give an investor exposure to a general partner, which can create opportunities to gain access to future opportunities from that partner. The other statements are all incorrect. Secondary trading may allow investors to get into a private equity deal at a later stage and, thus, realize positive returns more quickly. Secondary trading provides liquidity and makes it easier for institutional investors to make strategic shifts in their portfolios. Secondary markets are often used by investors due to changing portfolio needs, rather than a change in the value of their private equity funds. (LO 22.5)

4. **A** KKR's buyout deals of RJR Nabisco and TXU are the two largest buyout deals in history. In the past, the buyout market was segmented, but it is now an efficient auction market. Both the events of the 1990s and 2007–2008 caused the buyout market to contract as the debt financing required for buyouts became too expensive to allow for profitable deals. (LO 22.2)

5. **D** Private equity firms typically have a higher return hurdle rate than hedge funds. Since the price paid for a deal directly affects the return that can be earned, private equity firms are at a disadvantage in the bidding process compared to hedge funds because they must submit lower bids to increase the likelihood of meeting their hurdle rate. (LO 22.5)

6. **A** Private equity firms have a history of dealing with banks and other fixed income investors to finance their buyouts, which provide a natural entry into the leveraged loan market as an extension of private equity firms' existing financing activities. (LO 22.3)

7. **A** Investors in a toxic PIPE have incentive to drive the price of the issuer's stock down in a death spiral that will increase the equity conversion ratio and the number of shares the investors will receive. If they short the stock, the depressed stock price will allow the investors to earn large profits by purchasing the issuer's stock cheaply and then covering their short positions. Alternatively, the investors may hold onto the stock to take control of the company. Death spirals can be prevented through fixed conversion prices (i.e., traditional PIPEs) or by using price floor provisions. (LO 22.5)

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8. **D** The premium or discount as a percentage of NAV is calculated as follows:

   premium (discount) as a percentage of NAV = (market price / NAV) – 1

   premium (discount) as a percentage of NAV = (45 / 40) – 1 = 12.5%. (LO 22.4)

9. **A** BDCs can avoid corporate income tax, thereby only subjecting the shareholders to *one* level of taxation, the personal tax on the distributed profits. Studies suggest that there is little or no diversification benefit by adding investments in listed BDCs to an existing portfolio of listed equities. That is because listed BDCs exhibit return patterns that are highly correlated to listed equities. Investments in publicly traded shares of private equity asset management companies provide investors with *indirect* exposure to private equity returns. The carried interest earned by the companies for their underlying private equity management services serves as the source of return to the investors. (LO 22.4)

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The following is a review of the Private Equity principles designed to address the learning objectives set forth by the CAIA Association®.

Equity Types of Private Equity

Topic 5.2

Exam Focus

In this topic review, we will further examine the two types of equities used in private equity deals: venture capital and buyouts. Be sure to understand the major differences between buyout and venture capital deals. Be able to describe and define various aspects of venture capital as well as describe attributes of portfolio companies, such as the major components of a startup firm's business plan. Know the investment characteristics of buyouts including how returns are calculated, how buyouts create value, fee structures, and major risks. Also important are the various buyout fund structures, the concept of vintage year, and agency problems.

Private Equity Securities: Venture Capital vs. Buyouts

LO 23.1: Demonstrate knowledge of the relationships between venture capital and leveraged buyouts.

For example:

- **Recognize the role of venture capital and leveraged buyouts as sources of funding for corporations through their life cycle.**

When comparing venture capital and buyouts, several differences exist in the target companies (i.e., startup firms and mature companies) and in the financing of each strategy. These differences are detailed in Figure 1 and Figure 2.

Figure 1: Target Company Characteristics

	Type of Target Company	
Characteristic	*Startup Firms*	*Mature Companies*
Targeted by	Venture capital	Buyouts
Product market	Developing	Developed
Product demand	Unknown	Known
Management	Entrepreneurs skilled at generating ideas	Veterans skilled at operations management
Revenues	Just starting	Recurring and predictable
Rate of capital consumption	High	Low
Competitive advantage	New technology	More efficient firm operations

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Figure 2: Financing Differences

Financing Difference	*Venture Capital*	*Buyouts*
Target IRR	Relatively high	Moderate
Ownership	Activist minority shareholder	Activist controlling shareholder
Debt level	None	High
Strategy for target firm	Finance product innovation	Improve operations
Exit strategy	Initial public offering (IPO) or acquisition	Initial public offering (IPO), acquisition, or recapitalization

Venture Capital Portfolio Companies

LO 23.2: Demonstrate knowledge of the underlying businesses (portfolio companies) of venture capital.

For example:
- **Recognize characteristics of businesses underlying venture capital investment.**
- **List the types of securities used in venture capital.**
- **Explain why venture capital investing is similar to purchasing a call option.**
- **Describe the role of business plans and exit plans in venture capital investment.**

Venture Capital Investment

Venture capital consists of investing in new businesses that are started by entrepreneurs. Venture capitalists take active roles as advisors and directors of the firms in which they invest and typically have the right to hire or dismiss managers of the firms. They may bring value to the firm by giving it access to other firms that may be potential customers, as well as to necessary services such as lawyers and accountants.

The securities most often used in venture capital investing are convertible preferred shares. The advantage of convertible preferred stock to the venture capital investor is that it provides a senior claim, relative to common shareholders, to dividend payments or to assets if the firm is liquidated. In addition, if the firm conducts an IPO, the venture capital investor can convert the preferred shares to common. Other securities that may be used in venture capital investing include convertible debt and warrants to purchase the firm's common shares.

Venture capital investing may be compared to buying call options. The amount invested in a startup firm is similar to a call option premium in that it will be lost if the firm fails, as most startup firms do, but may give the investor substantial upside if the firm succeeds. Thus, in a venture capital portfolio, a few successes must outweigh the more frequent failures. The result is a pattern of returns that is highly right-skewed and exhibits positive excess kurtosis.

Business Plans and Exit Plans

When investigating a potential investment opportunity, venture capitalists focus on the startup firm's business plan. Components of the **business plan** include explicit statement of business strategy, identification of the needs filled by company's products/services, and

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a description of resources needed to create and sell the products/services. The objectives of this plan are two-fold:

- Serve as an internal plan to guide the company's direction.
- Convince venture capitalists to invest in the company.

The business plan must be internally consistent, logical, and comprehensive, in addition to being realistic. The executive summary of the business plan should summarize the nine major parts of the plan, which includes the essential information regarding the business opportunity. The nine major parts of the business plan are as follows:

1. *Market.* The market section should discuss whether a market already exists for the start-up firm's product.

2. *Product.* This section describes the products and/or services that the firm intends to sell.

3. *Intellectual property rights.* If a startup has rights to developed intellectual property, the rights must be verified.

4. *Startup management team.* The team will be carefully evaluated. Sometimes it may be necessary to bring in experienced management professionals from outside the startup.

5. *Operations.* The startup operational plans should be explicitly laid out in the business plan.

6. *Prior operating history.* Venture capitalists will verify that there is no unusual prior history, such as a bankruptcy or business failure.

7. *Financial forecasts.* This section includes forecasts for the income statement, balance sheet, and cash flow statement.

8. *Financing schedule.* In this section, the firm should identify the amount of financing it requires. The financial forecasts should be consistent with this section. The monthly cash burn rate multiplied by the investment horizon should equal the required financing.

9. *Exit plan.* Proper exit strategies are critical to ensure the eventual realization of value. Venture capitalists typically wish to be compensated in convertible preferred stock since convertible preferred has priority over common stock with regard to dividends, voting rights, and liquidation preferences. These shares can be converted to common shares in the event of an initial public offering (IPO). Successful venture capital investments can earn very large returns for investors upon exit. For example, the term **20-bagger** is used to describe investments where the investor earns a profit of 20 times the original investment. Investments in venture capital have a potential payoff profile similar to a long call option, as both have limited downside (i.e., cost of venture capital investment/option premium), unlimited upside, large positive skew, and leptokurtosis.

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Venture Capital Funds

LO 23.3: Demonstrate knowledge of venture capital funds.

For example:
- Define a venture capital fund.
- Recognize how venture capital fund managers raise capital.
- Recognize the terms of the partnership agreement of venture capital funds.
- Describe typical venture capital fund fee structures.
- Calculate venture capital fund fees.

Venture Capital Financing

A **venture capital fund** is a private equity fund that invests in startup firms. The primary venture capital fund structure is the limited partnership with the venture capitalist (also known as the *VC fund manager*) as the general partner and the other investors as limited partners. In the general partner role, the venture capitalist has full control of the fund with the exceptions noted in the covenants to the fund's partnership documents. The initial role of the general partner is to raise funds. After this, the general partner focuses on active management of the fund. Typical responsibilities include identifying attractive investment opportunities, performing due diligence, working with portfolio companies to implement their business plans, and exiting investments. The structure provides limited liability to investors and unlimited liability to the general partner. **Limited liability** means that the limited partners can only lose up to the value of their investment; there is no personal liability for the activities of the fund.

There are three main categories of protective covenants in venture capital limited partnerships:

1. *Covenants regarding fund management.* A typical covenant regarding fund management is a restriction on the size of an investment in any one firm. This position limit serves as a risk limit and encourages some level of diversification. Another typical covenant regarding fund management is a restriction or limit on the use of gearing. **Gearing** refers to a fund adopting a more risky investment style that includes greater leverage. Additional covenants regarding fund management generally include guidelines on the payout of profits and restrictions on making investments with other venture funds controlled by the venture capitalist.

2. *Covenants regarding general partner activities.* Covenants specific to the venture capitalist may restrict or place limits on private investments in companies in which the fund invests. There will also generally be a covenant restricting the sale of the general partnership interest to a third party. Additionally, the venture capitalist will likely face restrictions on future fundraising and on outside activities in order to keep the venture capitalist focused on the fund.

3. *Covenants regarding allowable investments.* The covenants that define allowable investments are generally written to restrict the venture capitalist to the types of investments about which she has knowledge. Limited partners prefer that the venture capitalist focus on her area of expertise.

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Fee Structure of Venture Capital

Like hedge funds, venture capital funds have a management fee and an incentive fee. The typical management fee is in the range of 1.0–3.5%, and the typical incentive fee is 20%. The management fee is assessed on **committed capital**, which is the capital pledged by investors to be invested, not the actual invested capital. Management fees are charged as soon as the fundraising period is complete. The venture capitalist may call the capital (i.e., make a **capital call**) on the dates specified in the subscription agreement (i.e., the investor's agreement to provide capital). The venture capitalist is, therefore, paid to hold an option to call investors' capital.

The incentive fee structure of venture capital works the same way as incentive fees for hedge funds. The venture capitalist is paid a percentage of profits if the fund makes a profit and zero otherwise. This fee structure has the same implications for venture capitalists as for hedge fund managers in that there is an incentive for the managers to increase fund volatility. Venture capital funds typically have covenants to combat this issue, including the following:

- A **clawback provision** grants the limited partners the ability to reclaim incentive fees at liquidation if they have experienced a loss of capital.
- An **escrow agreement** requires that a portion of the venture capitalist's incentive fee be held in a separate account (i.e., an escrow account) until all limited partners have earned a profit.
- A *prohibition on the distribution of profit-sharing fees* to venture capitalists until all capital is returned to the limited partners ensures that the capital is returned to the limited partners before fees are paid to the venture capitalists.

Example: Calculating venture capital fund management fees

The Angel Shark Venture Capital Fund has committed capital of $400 million and a management fee of 3.5%. After one year, the fund has invested 60% of its committed capital.

1. **Determine** the management fees for the fund in Year 1.

2. Assume the fund has a lifespan of eight years and the discount rate is 6%. **Calculate** the present value of the fund's management fees.

Answer:

1. management $\text{fees}_{\text{Year 1}}$ = $400 million × 3.5% = $14 million

   The management fees are based on committed capital rather than on invested capital. As a result, the general partners of the fund would earn a management fee of $14 million in Year 1.

2. The present value of the fund's lifetime management fees is calculated as follows:

   N = 8; I/Y = 6.0; PMT = $14,000,000; CPT → PV = $86,937,113

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The Investment Process of Venture Capital Investing

LO 23.4: Demonstrate knowledge of the dynamics of investing in venture capital.

For example:

- **Describe the stages of the life cycle of venture capital funds and portfolio companies.**
- **Explain the importance of financing stages in distinguishing among various venture capital funds.**
- **Explain the compound option that is embedded in most venture capital investments.**
- **Discuss the concept of the J-curve in the context of a start-up company.**

Venture Capital Fund Life Cycle and Stages of Financing

Investments in venture capital require a long-term commitment because the standard life cycle for a venture capital fund is 10 years. There are five stages associated with the life cycle of a venture capital fund. Figure 3 summarizes each of the five stages.

Figure 3: Venture Capital Life Cycle Stages

Stage Number	*Stage*	*Description*
1	Fundraising	The venture capitalist obtains capital commitments from investors. No funds are invested during this stage, which typically lasts six months to a year.
2	Sourcing investments	After the fund is closed to new investors, the venture capitalist begins reviewing potential venture capital opportunities (i.e., sourcing investments). No funds are invested during this stage. Fund managers will begin drawing management fees, and the fund will decrease in value. This stage can last up to five years.
3	Investment commitment	The venture capitalist determines in which firms to invest and how much to invest. Capital calls are made and funds are invested. Management fees are still being drawn; however, the investments will not be yielding profits. This stage partially overlaps with Stage 2 as it usually takes place in years three to five.
4	Investment management	All of the capital has been invested, and the venture capitalist begins work with the portfolio firms by providing business expertise related to marketing, development, production, et cetera. The investments may become profitable and eventually offset earlier management fees. Exit strategy plans for portfolio firms may also start being formed in this stage.
5	Fund liquidation	The fund is closed by selling each of the fund's investments off or through bankruptcy liquidation. If the fund is profitable, the fund distributes profits to all partners and the general partner collects an incentive fee.

Figure 4 illustrates the **J-curve** effect that is associated with a venture capital fund and plots the stages of a venture capital fund on the curve. In venture capital investing (and private equity in general), there is a tendency toward negative profits in the initial years due

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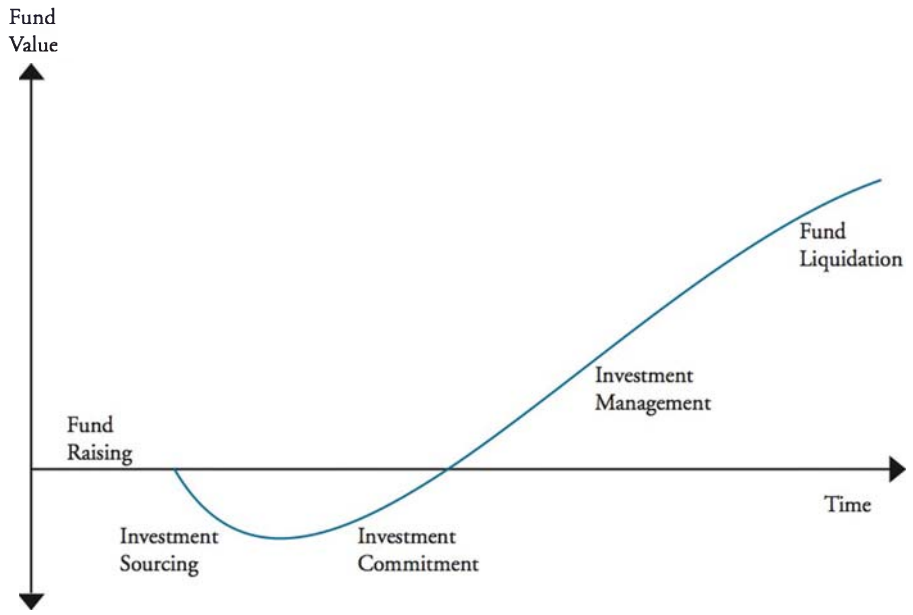
to management fees and other expenses exceeding cash inflows followed by a recouping of losses and eventually overall profit. The J-curve is the graphical plot of this effect with profits or fund value on the y-axis and time on the x-axis.

Figure 4: Venture Capital Fund Life Cycle



Stages of Financing for a Startup Company

There are five stages of financing for a startup company. Venture capitalist funds participate in any or all of the last four stages. The five stages of financing are:

1. *Angel investing.* The first financing for a business idea comes from friends, family, and fools (known as the three Fs) as well as wealthy individuals. This stage of financing is typically less formal and includes less documentation than investments at the later stages. Financing at this point is $50,000–$500,000. Business activities during this stage of financing include developing a prototype and writing a business plan. This stage serves to develop the business idea.

2. *Seed capital.* At this point in the business, there may be some form of management team assembled as well as a business plan. Business activities during this stage include finishing the prototype, alpha testing, and beta testing. Alpha testing refers to internal laboratory testing. Beta testing refers to initial product testing and assessment by potential customers. This is the first stage of financing for a startup company in which venture capital investors participate. Firms participating in seed financing are usually smaller and only provide a total of $1–$5 million in capital. Larger venture capital firms typically do not want to get involved at this stage, as it can be very time consuming and risky. This is a risky stage for venture capital investors because the business does not have a finished product and is, therefore, not yet profitable.

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3. *First-stage or early-stage venture capital.* A business that has made it to this stage of financing has a product that has successfully made it through beta testing. During this stage, the product moves into the second stage of customer testing using second-generation prototypes. Other activities in this stage include marketing the product and establishing distribution channels. The business begins making sales during this stage and attempting to create a market for its product. Financing during this stage is generally $2 million or more.

4. *Second-stage or late-stage expansion venture capital.* In this stage, the product has penetrated the market and is established in the marketplace. The business will either be profitable or breaking even at this point; however, the business's growth rate will be high to the point that the firm will not be able to sustain its own growth. Sales and accounts receivables are growing, but cash collections are lagging. Therefore, the firm will require outside financing. Most venture capital firms prefer to invest during this stage—returns are lower, but so is the risk, and there is a more rapid return of capital invested. Financing during this stage is generally $5–$25 million and serves to get the business through the cash crunch associated with high initial growth.

5. *Mezzanine venture capital or pre-IPO financing.* This stage is the final stage of venture capital before the firm is sold either through an IPO or to private investors. By this stage, the company has matured with respect to the product design, company management, marketing, and distribution. At this stage, the product may be a second-generation product and the firm has demonstrated a proven track record. Bridge financing is required to take the firm to the point where it can be sold. **Mezzanine venture capital** (or pre-IPO financing) during this stage is generally in the $5–$25 million range and may take the form of convertible debt. Ownership stakes of some investors may be purchased with the mezzanine debt proceeds. In addition to venture capital and mezzanine debt, the business may be able to obtain a traditional loan.

Viewing Venture Capital as a Compound Option

While we previously mentioned how venture capital investments can be viewed as call options, we now examine how they can also be viewed as compound options. **Compound options** are options on options. A compound option consists of two strike prices and two exercise dates. The first strike price and exercise date are used by the holder to evaluate whether to exercise the first option to receive the second option (where the second option is an option on the underlying asset) or just let the compound option expire. For example, a call on a call is a type of compound option that gives the investor the right to buy a call option at a set price for a set amount of time. In a venture capital setting, compound options mean that at each stage of financing an investor may be given the option to invest additional money in the startup business or let this option expire.

For example, consider a wealthy investor who decides to invest $150,000 in a mobile technology company during the angel investor phase. The investor will be given first priority to invest additional capital in the company during the next stage, seed capital, if the company is able to reach this stage. If the investor decides not to invest in the company due to business plan issues or other reasons, then the investor is effectively allowing his option to expire. However, if he decides to exercise this option, he may be given another option to invest at the next stage, early capital. This continues until the startup company reaches its IPO, is sold, or is shut down.

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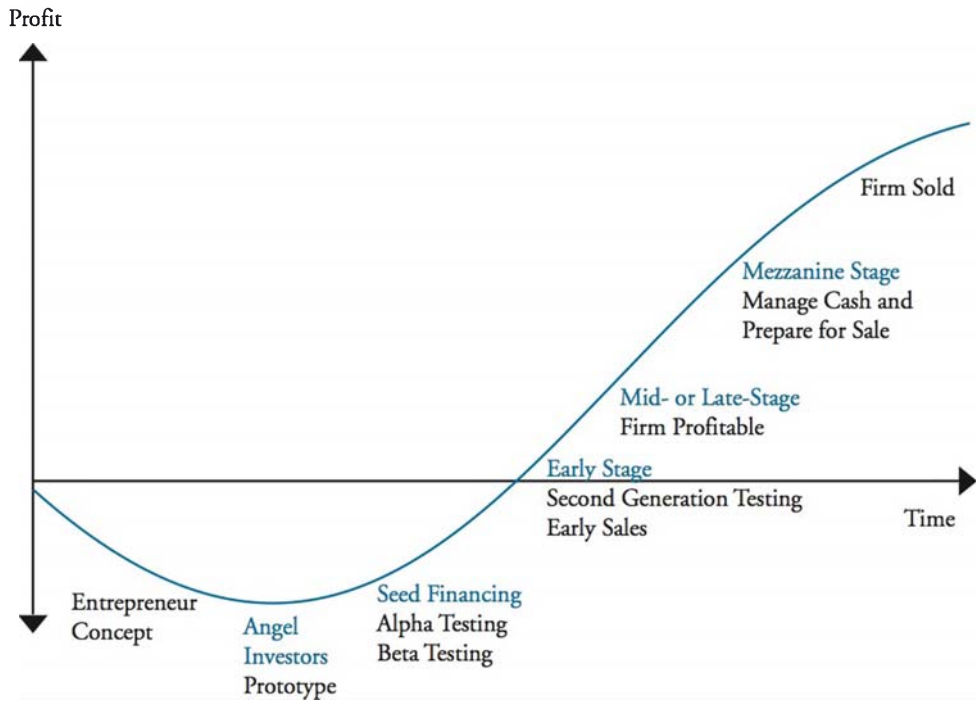
Much like option investors, venture capital investors need to evaluate each option to determine if its return potential exceeds its risk level. For example, venture capital investors may establish **milestones**, which are goals a company must reach before they will invest any additional capital in the company. By viewing each successive investment as an individual option, the investor is able to disregard sunk costs and evaluate each investment on its own merits.

Professor's Note: The compound option view of venture capital is similar to the real options on real estate development that we covered in the Real Estate Equity Investments topic review.

The J-Curve

Figure 5 illustrates the J-curve for startup companies. The stages of financing are indicated on the curve in blue text with the associated business activities that occur during that stage in black text. It is important to understand that while a company is not making profits in the early stages, it is not necessarily losing value. That is, capital is being used to turn the entrepreneur's concept into a marketable product, and the company's cash flows are negative. However, the value of a venture capital investment can actually increase during this time if the product is advancing quicker than expected or if the expected profits from the company are revised upwards. Note that because interim IRRs are used to create the J-curve in the early stages, a company's use of conservative accounting estimates will bias the curve downward.

Figure 5: Startup Company J-Curve



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Risks and Returns of Venture Capital

LO 23.5: Demonstrate knowledge of the risk and return characteristics of venture capital investments.

For example:

- **Describe the main risks of venture capital investments (i.e., business risk, liquidity risk, and idiosyncratic risk).**
- **Describe return persistence and vintage-year diversification as keys to successful venture capital investment.**
- **Recognize inferences that can be drawn from comparing definable characteristics of venture capital investments with their historical stand-alone and portfolio performances.**

Venture capital investors expect to earn a relative return that is equal to the return of the public stock market plus 4–8%. The excess returns can be attributed to venture capital investments possessing the following three forms of risk premiums:

1. **Business risk.** A venture capital firm has no established track record and is pre-IPO. Many venture capital firms fail before reaching the IPO stage. The high risk of failure results in investors demanding a high return.

2. **Liquidity risk.** Unlike publicly traded investments, venture capital investments are difficult to exit before the IPO stage. Investors who must exit early will likely be forced to sell their venture capital stakes at a severe discount.

3. **Idiosyncratic risk.** Compared to other investment types, venture capital funds are much less diversified. Fund managers rely on their sector-specific expertise when selecting portfolio companies. As a result, venture capital funds suffer from a lack of diversification. In a departure from CAPM principles, venture capital investors must be compensated for both systematic and unsystematic risk.

Return Persistence and Vintage-Year Diversification

Important components of venture capital investing include the following:

- **Return persistence.** Much like other private equity types, the difference between top-quartile and bottom-quartile venture capital managers is substantial. In addition, venture capital managers exhibit performance persistence in that successful fund managers tend to have successful follow-on funds, in part because entrepreneurs with the best business plans tend to seek financing from venture capital managers who have succeeded in the past. However, unlike public investments, access to venture capital funds is quite limited. Therefore, *gaining investment access* to the funds of top-quartile managers is a key to investor success.
- **Vintage-year diversification.** The *vintage year* refers to the calendar year that a venture capital fund was established and the first drawdown of capital was made. If capital is to be fully invested in portfolio companies and undrawn commitments are to be minimized, funds must be diversified across vintage years. Returns may vary widely depending on the vintage year. Historically, a leading cause of poor performance has been a lack of vintage-year diversification. To avoid underperformance, investors need to spread capital over various vintage years as well as across venture capital sectors.

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Historical Performance of Venture Capital

To evaluate the recent performance of venture capital and overall private equity, we use the Cambridge Associates Venture Capital Index and the overall Cambridge Associates Private Equity Index as proxies. From 2000–2014, venture capital underperformed both private and public equity as it had a low return, substantial volatility, a small Sharpe ratio, and the highest maximum drawdown.

Conversely, private equity as a whole had a solid stand-alone performance during this period as shown by its high Sharpe ratio. While overall private equity offers strong diversification benefits for a global bond portfolio due to negative correlation (not shown), its diversification benefits are quite limited for a world equity portfolio due to the strong positive correlation. In addition, both venture capital and private equity had strong negative performance during extreme market events, further limiting their diversification potential.

Figure 6: Venture Capital and Private Equity Performance, 2000–2014

	Annualized Arithmetic Mean	*Annualized Standard Deviation*	*Skewness*	*Sharpe Ratio*	*Maximum Drawdown*	*Correlation with Global Equity*
Venture capital	3.4%	15.1%	0.1	0.08	–69.7%	0.43
Private equity	11.3%	10.6%	–0.6	0.86	–25.1%	0.77
World equity	4.7%	17.9%	–0.4	0.14	–49.0%	1.00

Buyout Types

LO 23.6: Demonstrate knowledge of types of buyout transactions.

For example:
- **Distinguish leveraged buyouts (LBOs) from traditional investments.**
- **Describe a management buyout (MBO).**
- **Contrast a management buy-in (MBI) with a buy-in management buyout, and describe the agency issues of buyouts.**

Differences from Traditional Investments

While **leveraged buyout** (LBO) investments are technically traditional investments, they differ significantly from publicly traded stocks and bonds. The three primary differences are:

1. LBOs require activist investors that become controlling shareholders in the company. Investors in traditional investments typically are passive, minority stakeholders.

2. LBOs rely on a substantial amount of leverage unlike traditional investments.

3. LBO investments are not publicly traded despite their reliance on traditional investments to acquire financing and obtain company control.

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Management Buyouts and Buy-Ins

A buyout in which a firm's current managers take the firm private is known as a **management buyout (MBO)**. An MBO often has a goal of allowing the managers to focus on creating long-term value in ways they might not be able to when the firm is publicly traded and has investors who are more concerned with shorter-term performance.

In contrast with an MBO, a **management buy-in (MBI)** is an LBO led by a management team from outside the firm, which replaces the firm's current managers. If a buyout is led by a combination of some current managers and some new outside managers, the transaction is known as a **buy-in management buyout**.

Management buyouts or buy-ins may create principal-agent conflicts between the interests of common shareholders (principals) and the interests of the firm's current managers (agents). In an MBO, the conflict is that the managers believe the firm has long-term value that they can create, but this value will accrue to themselves rather than to the current shareholders. This may be viewed as violating their fiduciary duty to the shareholders. The counterargument is that the price the shareholders will receive in the MBO reflects a premium that would not have been attainable if the firm continued to be publicly traded, and, therefore, the managers are fulfilling their fiduciary duty to the shareholders by completing the MBO.

Different conflicts arise from an MBI. Managers who will be replaced have an incentive to fight a buyout attempt even if it benefits the shareholders. To overcome this incentive, the outside management team may have to offer them a **golden parachute**, or compensation for leaving the firm. This in turn may lead managers to encourage a buyout that offers them the most compensation rather than one that is better for shareholders.

Leveraged Buyouts

LO 23.7: Demonstrate knowledge of leveraged buyout (LBO) transactions.

For example:

- **Describe the structure of LBO funds and the role of various entities involved in LBO transactions.**
- **Describe typical LBO fund fee structures.**
- **Calculate LBO fees.**
- **Describe agency relationships, their associated costs, and their role as a potential source of return to LBO transactions.**
- **Describe general categories of LBO transactions and how they create value.**
- **Discuss the characteristics of portfolio companies of LBO funds.**
- **Explain the appeal of a leveraged buyout to managers and investors of the target firm.**
- **Describe the call-option characteristics embedded in potential payouts of a leveraged buyout.**
- **Apply the constant growth model to the valuation of a leveraged buyout investment.**
- **Describe typical exit strategies of LBOs.**
- **Describe the concept of spillover of corporate governance to the public markets.**
- **Explain auction markets and club deals as alternatives to the single-sourced approach to funding LBO transactions.**
- **Discuss why LBO funds tend to have less risk than venture capital funds.**

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LBO Fund Structures

LBO funds are limited partnerships, similar in design to hedge funds and venture capital funds. All three fund types rely on the safe harbor provision of the Investment Company Act of 1940 to avoid regulatory registrations. To qualify, funds must not engage in public offerings and must have less than 100 investors. In contrast to hedge funds and venture capital, LBO fund fees (detailed in the next section) tend to be more numerous.

An LBO fund has a general partner, which typically is the LBO firm itself, but it also has limited partners who are passive investors. Sometimes an advisory board consisting of a small number of limited partners is set up to advise on issues related to acquiring companies, collecting fees, making valuation decisions, and determining dividend payment methods for its acquired companies.

Funds are typically structured to operate for a 10-year period, with an option to extend the fund's life by up to two years. During the first three to five years of a fund, investments in target companies are made. As the portfolio companies are sold or go public, the proceeds are distributed to investors. Distributions may be *in kind*, which means that investors may receive shares in portfolio companies rather than cash. Distributions in kind usually only occur for publicly traded firms. General partners are often prohibited from starting a follow-on fund until the investment period is over. Therefore, new funds are typically created every three to five years.

LBO Fees

There are several avenues in which an LBO firm earns fees, including:

- *Management fees.* LBO firms typically charge a 1–3% fee for managing the capital committed to the investment fund. The fee will vary, depending on the strength and reputation of the LBO firm.
- *Profit-sharing fees.* As an incentive to perform well, LBO firms share in the profits of the investment pool or fund. The profit-sharing (incentive) fee is in the 20–30% range.
- *Privatization fees.* LBO firms may charge a fee to the firm that is being taken private. This fee for negotiating the transaction is usually about 1%. While some LBO general partners keep the entirety of this fee, others split the fee proceeds with the limited partners.
- *Break-up fees.* If the LBO deal does not go through, there can be a break-up fee paid to the LBO firm as part of the deal. For example, if the takeover bid is *topped* (i.e., a higher bid is submitted by another LBO firm), the original bidder may charge the target a fee.
- *Director fees.* General partners of an LBO fund often are part of the board of directors for its portfolio companies and receive compensation for these memberships.
- *Divestiture fees.* If the LBO firm arranges the sale of a division, there can be a divestiture fee for arranging this transaction.

Management fees can be a substantial part of an LBO firm's profit. For example, consider an LBO firm that raises $5 billion in capital for a new fund. If the management fee is 2% per year over the fund's 10-year life, the value of these fees to the LBO firm is the present value of a 10-year annuity of $100 million. Using a discount rate of 5%, this value is approximately $770 million.

The multitude of fees earned by the LBO firm and its general partners has been a subject of controversy. This is because LBO funds have increased greatly in size, often exceeding

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$10 billion, while their management fees have remained constant on a percentage basis. As a result, some investors have questioned whether the large management fees have caused LBO managers to focus on increasing their assets under management rather than focusing on maximizing investor returns.

Agency Costs

Agency refers to the interaction between principals and the agents acting on behalf of the principals. Agency problems occur when agents act in their own best interests rather than that of the principals, such as a manager acting in his own interests rather than those of the shareholders he is hired to serve. These problems lead to the following types of agency costs:

- *Cost to align management's goals with shareholders' goals*: Alignment of management's and shareholders' goals is generally achieved by creating incentives for management, such as performance-based compensation, stock options, et cetera.
- *Deterioration of shareholder value*: Management-led initiatives that are not in the best interest of the firm and that do not create value pose a significant cost.

Appropriate management incentives contribute to the likelihood of success of an LBO transaction. An LBO is attractive because instead of a large diverse group of passive shareholders, there is a small concentrated group of shareholders who can focus on building value and cash flows, without concerns about outside analysts, earnings per share pressure, and other issues associated with being a public company. This can contribute to the success of an LBO transaction and reduce agency costs.

Categories of LBOs

Leveraged buyout transactions vary in terms of the method by which value will be created or unlocked. In general, there are five categories for leveraged buyouts including the following:

1. **Efficiency buyouts.** This category refers to LBOs that improve operating efficiency. A diverse shareholder group with little ability to directly manage the firm is replaced by an LBO firm willing to take on an active overseer role. Management compensation is adjusted to focus on net profit margins and increasing the value of the company, rather than revenues, in an attempt to reduce principal-agent conflicts.

2. **Entrepreneurship stimulators.** A good way for an LBO to create value is to *free management* to concentrate on innovations, as opposed to time-consuming daily operations related to being a public entity. Another option is *freeing* a division by giving it operational autonomy to implement a separate business plan.

3. **Conglomerates.** These types of firms are attractive to LBO investors because they are overstuffed (i.e., excessively large or diverse) corporations with numerous operating divisions or subsidiaries, often in unrelated industries. If the LBO firm believes that these divisions are misunderstood by the investing public, and perhaps undervalued, then there is an opportunity to sell off some assets to focus on the undervalued core business.

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4. **Buy-and-build strategies.** In this LBO technique, several operating firms or divisions are acquired through additional buyouts and then combined. The goal is a strategic alignment and value creation through synergies. This strategy is also known as a *leveraged buildup strategy*.

5. **Turnaround strategies.** These involve LBO turnaround funds, which seek out underperforming firms with too much leverage and weak management. Turnaround funds primarily focus on two types of firms: (1) firms that are approaching bankruptcy and (2) firms that are owned by other LBO funds but are underperforming expectations.

Portfolio Characteristics of LBO Funds

LBO funds can be classified into the following categories depending on the revenues of the portfolio companies they acquire: small capitalization ($100 million–$1 billion in annual sales), medium capitalization ($1–$5 billion in annual sales), or large capitalization ($5 billion or more in annual sales). In addition, most LBO fund portfolios consist of 10–30 companies.

The business plan used by LBO funds is similar to that of venture capital. In both cases, fund employees will be appointed to the board of directors, and the fund will help firm management develop the business plan. However, in an LBO situation, the business plan often places a focus on reducing employee levels and business expenses.

Appeal of LBOs to Investors and Managers of Target Companies

Existing investors of LBO targets are often in favor of an LBO due to the premium price that the LBO is willing to pay for its equity holdings. In addition, existing corporate management (if retained) possesses the following advantages because of the LBO:

- The highly leveraged structure of the LBO results in substantial tax benefits, as interest payments made to debt holders are tax deductible.
- The level of regulatory requirements and investor communications is reduced, allowing management to focus on core business activities.
- If the LBO was previously part of a larger company, the management can now clearly focus on product goals rather than companywide initiatives that may have not been aligned with division success.
- If warrants are issued to management, managers receive direct financial benefits from any increase in the company's value.

Calculating LBO Returns

Like the venture capital payoffs we described earlier, LBO payoffs may be likened to those of a call option, with larger potential gains compared to the potential loss of the amount invested. The compound annual return on an LBO is a function of the value of the portfolio firm at the end of the debt paydown period, the amount of equity used in the LBO transaction, and the length of the debt paydown period. The return is computed as follows:

$$\text{LBO return} = \left(\frac{\text{firm value at the end of debt paydown period}}{\text{equity portion of LBO transaction}}\right)^{\left(\frac{1}{\text{debt paydown period}}\right)} - 1$$

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Example: LBO annual compounded return

Company X has a current market value equal to $650 million and has outstanding debt equal to $225 million. Company X's EBITDA has been holding steady at $95 million per year, providing an annual return on total capital (debt plus equity) of 10.9% [= 95 / (650 + 225)].

An LBO firm recognizes certain inefficiencies at Company X and offers to purchase the outstanding equity and pay off the outstanding debt for $1 billion. Company X accepts this offer.

The LBO firm proceeds to pay off the outstanding debt at its face value of $225 million. Equity holders receive $775 million (= 1,000 – 225). This amounts to a premium of 19.2% [= (775 / 650) – 1]. The premium is a deal sweetener used to gain the equity holders' support.

Of the $1 billion LBO transaction, only $225 million was financed with the investors' equity. The remaining $775 million was financed with 12% coupon bonds requiring annual debt service of $93 million (= 775 × 0.12).

Subsequent to the LBO, the investors are able to eliminate the operating inefficiencies at Company X, increasing EBITDA from $95 million to $140 million per year. Since the LBO investors will not pay dividends, all of the free cash flow can be used to pay down the debt to a zero balance in six years. After six years, Company X's EBITDA is expected to grow at a constant rate of 3%.

1. **Compute** the value of the company and the compounded annual growth if the discount rate for Company X is 14%.

2. **Compute** the value of the company and the compounded annual growth if the discount rate for Company X is 7%.

3. Assume that unforeseen complications have caused the LBO's debt paydown period to extend to eight years. **Compute** the value of the company and the compounded annual growth if the discount rate for Company X is 14%.

Answer:

1. If the appropriate discount rate for the company is 14%, the value of the company can be calculated using the constant growth dividend discount model:

   value of Company X = $140 million / (0.14 – 0.03) = $1.27 billion

   The compound annual return is calculated using the initial equity investment from the LBO investors as follows:

   compound annual return = ($1.27 billion / $225 million)$^{1/6}$ – 1 = 33.5%

2. Similar to question 1, the constant growth dividend discount model is used, but this time a discount rate of 7% is applied:

   value of Company X = \$140 million / (0.07 – 0.03) = \$3.5 billion

   The compound annual return is calculated using the initial equity investment from the LBO investors as follows:

   compound annual return = (\$3.5 billion / \$225 million)$^{1/6}$ – 1 = 58.0%

3. Using the \$1.27 billion company value we calculated in part 1, the compound annual return for an eight-year debt paydown period is calculated using the initial equity investment from the LBO investors as follows:

   compound annual return = (\$1.27 billion / \$225 million)$^{1/8}$ – 1 = 24.2%

   The substantial differences in the answers illustrate the importance of accurate forecasting when assessing the profit potential of available LBO investments.

Financing LBOs

LBO funds are financed through three primary sources:

1. *Senior debt*, which is provided by banks, finance companies, and insurance companies.

2. *Mezzanine debt*, which is provided by mezzanine debt funds, institutional investors, and investment banks.

3. *Equity*, which is provided by LBO firm and management.

LBO Exit Strategies

LBO equity investors can extract the value created by their LBO investment through the following six exit strategies:

1. *Sale to a strategic buyer.* This is the primary exit type and involves the sale of the portfolio company to a competitor in the same industry as the portfolio company.

2. *Sale to a financial buyer.* The LBO firm sells the portfolio company to another LBO firm. This is known as a **buyout-to-buyout** or **secondary buyout**. This exit strategy is becoming more popular and now accounts for 33% of all private equity deals.

3. *Sale via IPO.* Once the turnaround is complete, the portfolio company may be taken public via an initial public offering (IPO).

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4. *New LBO.* In this method, a completely new LBO is created using additional debt financing. This new LBO then purchases the equity stakes held by the original LBO investors.

5. *Refinancing.* If the company's value has appreciated significantly since the buyout, the portfolio company may refinance by taking on additional debt in order to pay equity investors a sizable dividend.

6. *Hybrid strategy.* Two or more of the preceding strategies may be combined to form a blended exit strategy.

Benefits of LBO Corporate Governance

Corporate governance is a process in which managers (i.e., agents) of a firm align interests with equity holders (i.e., principals). It is very important that the management of the target firm and the LBO firm have closely aligned interests and a solid business plan in place. There are four benefits for the public market that result from the application of corporate governance principles by LBO firms:

1. Strong corporate governance principles (e.g., incentives for managers and monitoring systems) enacted during the LBO often remain in place after the company becomes public again, maintaining the alignment of interests between management and the new public equity holders.

2. Managers of firms with lax corporate governance and shareholder monitoring are faced with the threat of being removed from their positions as a result of an LBO. Such a threat serves as a warning and provides incentive to enact better corporate governance principles.

3. Management incentive and shareholder monitoring programs created by LBO firms can provide a road map for other managers and shareholders. Managers can see how incentive programs maximize shareholder value and provide equitable compensation. Shareholders observe the power they can exercise over management.

4. The threat of LBOs helps prevent the formation of inefficient conglomerates. That is, the threat of an LBO reduces the likelihood of company managers making acquisitions that are not related to the company's core business.

Becoming an Efficient Market: An Auction Market for Private Equity

To understand the importance of the development of an auction market for LBOs, it is important to understand the history of the private equity market. Traditionally, a single private equity firm would approach a company with an idea for a deal. The deal may involve taking a public company private or having a parent company spin off a subsidiary. The private equity firm would work with management to develop a financing plan for the deal, which could take months or even years. The single private equity firm would build a long-term relationship with company management and work on the deal without competitive bidding from other firms.

Today's private equity market deals occur through an **auction process**, in which private equity firms compete for a deal through a bidding process organized by an investment banker. When multiple private equity firms are involved in a bidding process, the highest

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bidder will win the deal, resulting in less upside potential from the private equity deal and lower returns for investors.

Club deals are also becoming more common in the LBO market. A **club deal** occurs when multiple LBO firms work together on the details of a single deal. Working together may entail sharing costs, presenting a joint business plan, or contributing capital to a deal. The increased frequency of club deals can be attributed to large inflows of capital, which have forced private equity firms to work together rather than one-on-one with target company management. During the years 2000–2007, approximately 16% of completed LBO deals were club deals.

Advantages of club deals include the following:

- *Larger capital pool.* By combining the funds of each member of the club, private equity firms may be able to raise enough capital to buy companies that they would not be able to otherwise purchase.
- *Investment restrictions.* A typical restriction on an LBO fund is a limitation on allocating a specific amount of the fund's capital to a single firm. Club deals allow firms to pool capital and participate in deals that would otherwise not be available due to their large size.
- *Pooled resources.* Another benefit to club deals is that private equity firms can pool their resources to complete expensive activities, such as due diligence, and collaborate on the attractiveness of potential deals.

Disadvantages of club deals include the following:

- *Lack of market participants.* Club deals cause individual market participants to form bidding groups. This means fewer overall potential bidders and may potentially lower the price received by market sellers.
- *Lack of defined leadership for the business plan.* Having multiple firms involved means less clarity as to who will be in charge of the specific components of a deal, such as monitoring performance and negotiating with lenders.

Risks and Returns of LBO Funds Compared to Venture Capital

LBOs are significantly less risky than venture capital deals for the following reasons:

- An LBO target company has an established track record with proven products and/or services. Management of the LBO target also has an established track record. The products and/or services and a profit track record for the LBO target company are already established—the LBO simply unlocks management so that operations can be improved.
- LBO firms are more diversified than their venture capital counterparts. While venture capital firms tend to specialize in a particular industry (e.g., biotechnology), LBO firms focus on operations, which allows them to invest in any industry where an LBO opportunity is present.
- An IPO exit strategy is much more realistic for an LBO than for a venture capital company since the LBO target had public stock outstanding previously.

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Key Concepts

LO 23.1

Differences between venture capital and buyouts exist along the lines of the target company's characteristics and financing used. The target companies for venture capital are startup companies, whereas buyouts target established companies. The financing for venture capital is equity based, while buyouts use significant debt.

LO 23.2

The businesses in which venture capitalists invest are startup companies. A venture capital investor typically buys the companies' convertible preferred stock and takes an active role in advising the companies.

Components of a startup's business plan include explicit statement of business strategy, identification of the needs filled by the company's products/services, and a list of resources needed to create and sell the products/services. The business plan must be internally consistent, logical, and comprehensive, in addition to being realistic.

Proper exit strategies are critical to ensure the eventual realization of value. Venture capitalists typically wish to be compensated in convertible preferred stock. Investments in venture capital have a potential payoff profile similar to a long call option as both have limited downside (i.e., cost of venture capital investment/option premium), unlimited upside, large positive skew, and leptokurtosis.

LO 23.3

The primary structure of a venture capital fund is a limited partnership with the venture capitalist as the general partner and the other investors as limited partners. The structure provides limited liability to investors. Limited liability means that the limited partners can only lose up to the value of their investment; there is no personal liability for the activities of the fund.

Typical venture capital fund management fees are in the 1.0–3.5% range, and the typical incentive fee is 20%. Venture capital funds typically have covenants regarding incentive fees, including:

- A clawback provision.
- An escrow agreement.
- A prohibition on the distribution of profit-sharing fees to venture capitalist until all capital is returned to the limited partners.

LO 23.4

The venture capital life cycle is typically 10 years and includes the following five stages:

1. Fundraising.

2. Investment sourcing.

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3. Investment commitment.

4. Investment management.

5. Fund liquidation.

The five stages of financing for a startup company are:

1. Angel investing. Financing is $50,000–$500,000 and comes from friends, family, fools, and wealthy investors. Business activities include developing a prototype and writing a business plan.

2. Seed capital. Financing is $1–$5 million and may come from venture capital. Business activities during this stage of financing include finishing the prototype, alpha testing, and beta testing.

3. First-stage or early-stage venture capital. Financing is $2 million or more. During this stage, the product moves into second-generation customer testing and the firm begins sales.

4. Second-stage or late-stage expansion venture capital. Financing is $5–$25 million during this stage. The business will be either profitable or breaking even with high growth.

5. Mezzanine financing. Financing is $5–$25 million. This stage is the final stage of venture capital before the firm is sold either through an IPO or to private investors.

Compound options are options on options. In a venture capital setting, compound options mean that at each stage of financing, an investor may be given the option to invest additional money in the startup business or let this option expire. Investors need to evaluate each option on a stand-alone basis to determine if its return potential exceeds its risk level.

Startup companies are subject to the J-curve effect in that they initially have negative cash returns before earning profits in later periods. While the company is not making profits in the early stages, it is not necessarily losing value if the capital is being efficiently used to turn the entrepreneur's concept into a marketable product.

LO 23.5

Relative return expectations for venture capital investors are 4–8% higher than that of the stock market. The excess returns can be attributed to venture capital investments possessing the following three forms of risk premiums: (1) business risk, (2) liquidity risk, and (3) idiosyncratic risk.

The difference between top-quartile and bottom-quartile venture capital managers is substantial and manager performance is persistent, making access to top managers and their funds a primary determinant of investor performance. Another factor to successful venture capital investing is adequate vintage-year diversification.

In recent years, venture capital substantially underperformed both private and public equity as it had a low return, substantial volatility, a low Sharpe ratio, and the highest maximum drawdown. Its return distribution had slight positive skewness and substantial correlation to

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public equity. Conversely, private equity as a whole had very solid stand-alone performance during this period. Diversification benefits for private equity are quite limited for a global equity portfolio due to the strong positive correlation in both normal and extreme market conditions.

LO 23.6

LBO investments differ significantly from traditional investments in that they require activist, controlling investors and a substantial amount of leverage and are privately traded.

A management buyout (MBO) is an LBO led by the current managers of a company. A management buy-in (MBI) is an LBO led by an outside management team that replaces the company's current managers. Both MBOs and MBIs involve agency issues between the interests of shareholders and the interests of management.

LO 23.7

LBO funds, venture capital funds, and hedge funds often are structured as limited partnerships with the fund manager as general partner and sole decision maker. LBO funds tend to have higher fees. Funds are typically structured to operate for a 10-year period. During the first 3–5 years, investments in target companies are made. Investor distributions may be in kind, which means that investors may receive shares in portfolio companies rather than cash.

There are several ways in which an LBO firm earns fees:

- Management fees.
- Profit-sharing fees.
- Privatization fees.
- Break-up fees.
- Divestiture fees.

Agency problems occur when agents act in their own best interests rather than that of the principal, such as a manager acting in his own interests rather than those of the shareholders he is hired to serve. The primary types of agency costs are the cost to align management's goals with shareholders' goals and the deterioration of shareholder value.

LBOs fall under five general categories:

1. Efficiency buyouts.

2. Entrepreneurship stimulators.

3. Conglomerates.

4. Buy-and-build strategies.

5. Turnaround strategies.

LBO fund portfolios consist of 10–30 companies. The business plan chosen by LBO funds is similar to that of venture capital. In both cases, fund employees will be appointed to the board of directors and the fund will assist with business plan development. However, LBO business plans often emphasize reductions in operating costs.

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Current target firm investors are often in favor of an LBO due to the premium price paid by the LBO to acquire their ownership stakes. Retained corporate management benefits from the LBO due to the tax benefits of debt issuance, reduced regulatory and investor burdens, clear focus on business goals, and financial benefits from increases in company value.

The compound annual return on an LBO is computed as follows:

$$\text{LBO return} = \left(\frac{\text{firm value at the end of debt paydown period}}{\text{equity portion of LBO transaction}}\right)^{\left(\frac{1}{\text{debt paydown period}}\right)} - 1$$

LBO exit strategies include:

- Sale to a strategic buyer.
- Sale to a financial buyer.
- Sale via IPO.
- New LBO.
- Refinancing.
- Hybrid strategy.

There are four benefits for the public market that result from the application of corporate governance principles by LBO firms:

1. Strong corporate governance principles often remain in place after the company becomes public again.

2. Threat of LBO serves as a warning to public companies and provides current management an incentive to enact better corporate governance principles.

3. Incentive and monitoring programs created by LBO firms can provide a road map for management and shareholders after the firm becomes public again.

4. The threat of LBOs helps prevent the formation of inefficient conglomerates.

The private equity market has evolved from single-sourced deals to an auction market where multiple private equity firms compete for deals in a bidding process.

A club deal occurs when multiple LBO firms work together on the details of a single deal. Working together may entail sharing costs, presenting a joint business plan, or contributing capital to a deal. The increased frequency of club deals can be attributed to large inflows of capital, which have forced private equity firms to work together.

LBOs are significantly less risky than venture capital deals for the following reasons:

- An LBO target company has an established track record with proven products and/or services.
- LBO firms are more diversified.
- An IPO exit strategy is much more realistic for an LBO since the LBO target had public stock outstanding previously.

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Concept Checkers

1. The amount of financing requested by a startup firm in its business plan should equal the:
   A. amount required for fixed capital purchases.
   B. projected net loss over the first five years of operation.
   C. monthly cash burn rate multiplied by the investment horizon.
   D. monthly cost of goods sold multiplied by the investment horizon.

2. The most common form of investment vehicle for venture capital is the:
   A. limited partnership.
   B. limited liability company.
   C. venture capital fund of funds.
   D. corporate venture capital funds.

3. The first stage of the life cycle for a venture capital fund is:
   A. first or early capital stage.
   B. fundraising.
   C. seed capital.
   D. investment sourcing.

4. The first stage of financing for a startup company in which venture capital firms participate is:
   A. first or early capital stage.
   B. fundraising.
   C. seed capital.
   D. investment sourcing.

5. In general, LBO funds are set up as:
   A. limited liability corporations (LLCs).
   B. partnerships.
   C. closed end funds.
   D. limited partnerships.

6. LBO firms have a complex investment structure comprised of a variety of fees. There is a management fee for the investment capital committed to each investment fund. What is the usual range of this fee?
   A. 1–3%.
   B. 20–30%.
   C. 5–10%.
   D. 10–15%.

7. Another fee the LBO firm earns is a profit share of the investment pool. What is the usual range of these incentive or profit-sharing fees?
   A. 1–3%.
   B. 20–30%.
   C. 5–10%.
   D. 10–15%.

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8. The separation of ownership and corporate control results in what type of costs?
   A. Agency costs.
   B. Management incentive costs.
   C. Commitment fee costs.
   D. Additional debt costs.

9. When comparing venture capital deals to LBOs, the target company for an LBO has:
   A. an unknown product demand.
   B. a developing market environment.
   C. a customer base of early adopters.
   D. recurring and predictable revenues.

10. Which of the following LBO value creation methods is also known as a leveraged buildup strategy?
    A. Buy-and-build.
    B. Conglomerates.
    C. Entrepreneurship stimulators.
    D. Efficiency buyouts.

11. Which of the following is *least likely* a reason why LBOs are less risky than venture capital funds?
    A. Low levels of leverage used to finance the deal.
    B. Established revenue and profit streams for the target firm.
    C. Management of the target has an established track record.
    D. Seasoned target companies with public equity outstanding.

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Concept Checker Answers

1. **C** The amount of financing requested by a startup firm should equal the monthly cash burn rate from the financial projections section of the business plan multiplied by the investment horizon. (LO 23.2)

2. **A** The most common investment vehicle for venture capital is the limited partnership. (LO 23.3)

3. **B** The first stage of the life cycle for a venture capital fund is fundraising. The early stage and seed capital are stages of financing for a startup firm. Sourcing investments is the second stage of the life cycle for a venture capital fund. (LO 23.4)

4. **C** The first stage of financing in which venture capital funds invest is seed capital. The early stage is the second stage in which venture capital funds invest. Fundraising and investment sourcing are stages of the life cycle for a venture capital fund. (LO 23.4)

5. **D** LBO funds are typically set up as limited partnerships and run by a general partner. Limited partners are passive investors. (LO 23.7)

6. **A** The management fee is set in the range of 1–3%, depending on the LBO firm's strength. (LO 23.7)

7. **B** These incentive fees are typically high (in the 20–30% range). In addition to management fees and profit-sharing fees, LBO firms may also charge fees to the corporation itself that is taken private, up to 1% of the total selling price, as compensation for negotiating and arranging the transaction. (LO 23.7)

8. **A** Agency costs come in two different forms: cost to properly align management and shareholder goals and the erosion of stockholder value from management-led initiatives that do not create value for shareholders. (LO 23.7)

9. **D** The target company for an LBO transaction has an established product demand, a developed market environment, a widespread and established customer base, and recurring and predictable revenues. (LO 23.7)

10. **A** The buy-and-build strategy for value creation through LBO is also known as a leveraged buildup strategy. (LO 23.7)

11. **A** LBOs are highly risky due to their use of high amounts of leverage. LBOs are less risky than venture capital because the target companies are seasoned and have private equity outstanding, managements with established track records, and established revenue and profit streams. (LO 23.7)

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The following is a review of the Private Equity principles designed to address the learning objectives set forth by the CAIA Association®.

Debt Types of Private Equity

Topic 5.3

Exam Focus

In this topic review, we will further examine the two types of debt securities used in private equity deals: mezzanine debt and distressed debt. Mezzanine debt serves an important purpose in the world of private equity investing. For the exam, you should know the characteristics of mezzanine debt, how it is used, and the typical transactions in which it is employed. Additionally, you need to know how mezzanine debt compares to other forms of debt and the unique features of mezzanine debt. Distressed debt investing involves purchasing the debt of troubled firms with the objective of earning substantial returns after a successful turnaround of the target firms. For the exam, you need to understand the attributes of distressed debt and distressed debt investing strategies as well as the details of the U.S. Chapter 7 and 11 bankruptcy processes.

Mezzanine Debt

LO 24.1: Demonstrate knowledge of mezzanine debt.

For example:

- Describe characteristics of mezzanine debt, including typical exit strategies.
- Analyze how mezzanine debt affects company cost of capital.
- Calculate the weighted average cost of capital structures that include mezzanine debt.
- Compare and contrast mezzanine debt to leveraged loans and high-yield bonds.
- Describe seven typical examples of transactions that use mezzanine debt.
- Describe types of mezzanine debt investors, and recognize their motivations.
- Identify and describe eight characteristics that distinguish mezzanine debt from other types of financing.

Mezzanine debt is a hybrid of equity and debt. Because the structure of mezzanine debt is very flexible, a particular issue may be best classified as debt, while a different issue may be best classified as equity. The mezzanine debt investor seeks to receive a return of 8–14% from the debt component and an additional 5–10% from the equity kicker for a total expected return of 15–20%. Mezzanine debt covenants often contain a payment-in-kind (PIK) toggle. The **PIK toggle** allows the firm to issue coupons in the form of either cash or additional mezzanine debt.

Note that the two return components have an inverse relationship in that securities that pay a larger coupon rate tend to issue less warrants within the equity kicker component. Unlike other forms of private equity, the J-curve effect does not apply for mezzanine debt as investors in mezzanine financing receive immediate returns through semiannual interest payments.

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Exit Strategy

The most common exit strategy for mezzanine debt is for the investor to be repaid the full face value of the debt by the firm and the value of the stocks or warrants contained in the equity kicker. Firms tend to retire mezzanine debt after completing an initial public offering (IPO), acquisition by another firm, refinancing, or issuing common equity. All of these activities provide the firm an infusion of capital that allows the firm to repay mezzanine investors.

Lowering the Cost of Capital

In some instances, firms issue mezzanine debt to lower their weighted average cost of capital. **Weighted average cost of capital** (WACC) refers to the firm's overall funding costs in percentage terms (i.e., weighted equity cost + weighted after-tax debt cost). If a company can replace a portion of the expensive equity component with less expensive mezzanine debt, its WACC will be lower. However, the issuance of mezzanine debt typically results in equity investors requiring a higher return to compensate them for the additional risk associated with the issuance of mezzanine debt.

For example, consider a firm with a capital structure consisting of 50% equity and 50% debt. Assume the cost of equity is 25% and the after-tax cost of debt is 5%. The firm's current WACC would be calculated as follows:

$$\text{WACC} = (0.50 \times 0.25) + (0.50 \times 0.05) = 15.0\%$$

If the company decided to adjust its capital structure to use a 20% mezzanine debt at a cost of 18%, the equity component will decrease in weight to 30%. However, assume equity investors now expect a 28% return. Assuming that the debt component remains at 50% and its cost remains at 5%, the firm's new WACC would be:

$$\text{WACC} = (0.30 \times 0.28) + (0.50 \times 0.05) + (0.20 \times 0.18) = 14.5\%$$

In this scenario, the issuance of mezzanine debt would allow the firm to reduce its WACC by 0.5%. If capital markets were truly efficient, a firm would not be able to achieve this reduction in WACC through simple rebalancing. However, the firms that use mezzanine debt are typically medium sized. Because the capital markets for these companies are often inefficient, medium-sized firms may be able to use mezzanine debt to lower their WACC.

Comparison of Mezzanine Debt to Other Financing Types

As discussed briefly in the previous paragraph, mezzanine debt fills the gap in capital markets for financing available to middle market companies. Therefore, the maximum total mezzanine debt issued by a single firm tends to be around $400 million. Larger companies use high-yield bonds and leveraged loans rather than mezzanine financing. Mezzanine debt structures are customized and negotiated between counterparties, making them much less liquid than the high-yield bonds and leveraged loans. Investors looking to sell their mezzanine debt early will typically be forced to do so at a large discount.

Mezzanine debt covenants generally allow a maximum **loan-to-EBITDA** (earnings before interest, taxes, depreciation, and amortization) **multiple** of 4.0–4.5, whereas bank

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and senior loans only allow a maximum ratio of 2.0–2.5. Figure 1 details the major characteristics of leveraged loans, high-yield bonds, and mezzanine debt relative to each other.

Figure 1: Characteristics of Financing Types

	Leveraged Loans	*High-Yield Bonds*	*Mezzanine Debt*
Borrower size	Large	Large	Medium
Seniority	Greater seniority than high-yield bonds and mezzanine debt	Contractual and structural subordination	Lowest seniority
Asset claim	First lien on borrower's assets	Unsecured (i.e., no direct claim)	Unsecured (i.e., no direct claim)
Credit rating of borrower	Required	Required	Not required
Loan covenants	Extensive loan covenants protect lender	Moderate loan covenants	Limited covenants; pertain to coupon payments
Term (maturity)	5 years	7–10 years	4–6 years
Principal repayment (i.e., amortization)	Installment payments	Bullet payment upon maturity	Bullet payment upon maturity
Coupon form	Cash	Cash	Cash or payment in kind
Coupon rate	Floating; LIBOR + spread	Fixed; 5–8%	Fixed; 8–14%
Prepayment penalty	None	Large penalty in the form of call premium	Moderate penalty
Presence of equity kicker	No	Potentially	Normally
Recovery rate (in event of default)	60–100%	40–50%	20–30%
Liquidity level	High	Low	Minimal

Examples of Mezzanine Financing

Mezzanine financing is typically used in seven different types of transactions:

1. *Management buyouts*, where a management team leads the buyout of the team's own firm, can be financed in part by mezzanine financing. The benefit to using mezzanine financing is it can fill the gap between equity and senior debt.

2. *Growth and/or expansion* can be supported through mezzanine financing. A firm that is growing quickly will require cash infusions to sustain growth that traditional lenders may be unwilling to provide. Mezzanine financing can provide medium-sized firms a financing solution to these issues.

3. *Acquisitions* occur when one firm purchases another firm. Mezzanine financing can provide the capital required to make the acquisition.

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4. *Company recapitalizations* occur when a company engages in financing activities with the intent to change its capital structure. Generally, in a leveraged recapitalization, some of the firm's equity is replaced with debt. Mezzanine financing can be a source of funds to support a firm's recapitalization goals.

5. *Commercial real estate financing* is another area where the use of mezzanine financing has become more popular. Mezzanine financing is used in between equity financing and the first mortgage. First mortgages will typically constitute 40–75% of a real estate asset's value, while mezzanine financing and equity will contribute 10–40% and 10–15%, respectively.

6. *Leveraged buyouts*, which were discussed in detail in the previous topic review, will often employ mezzanine financing to secure adequate capital for a buyout.

7. *Bridge financing* is short-term financing that serves as a bridge by creating liquidity until an expected future inflow of cash. Mezzanine financing can be used as the means of financing the bridge.

Mezzanine Debt Investors

The four primary groups of lenders/investors with regard to mezzanine debt include mezzanine funds, insurance companies, traditional senior lenders, and traditional venture capital firms. Mezzanine debt investors typically are passive investors with no interest in obtaining control of the company.

1. *Mezzanine funds.* Mezzanine funds possess similar infrastructure to hedge funds, venture capital funds, and leveraged buyout funds and charge similar fees with a management fee of 1–2% and an incentive fee of 20%. Limited partners are typically institutional investors, such as pension funds, endowments, and foundations. Mezzanine funds seek to provide a return in the 15–20% range, which is slightly below leveraged buyout (LBO) funds (20–30%) and considerably below venture capital funds (30–50%). Mezzanine funds tend to have staff with finance backgrounds skilled at negotiating the proper issue structure rather than the technical skills often found on a venture capital team. In addition, mezzanine funds tend to be smaller than other private equity funds due to the relatively small mezzanine debt issues ($5–400 million).

2. *Insurance companies.* Insurance companies often invest directly in mezzanine debt issues. Because their liabilities are long-term in nature (e.g., life insurance), the illiquidity associated with issuing mezzanine debt is not a concern. However, because of the nature of their liabilities, insurance companies need a stable source of income and, therefore, place a higher value on the fixed income component of mezzanine debt and gravitate towards mezzanine debt issues that are more debt-like in nature.

3. *Traditional senior lenders.* Traditional lenders, such as banks, also often participate in mezzanine lending. After traditional lending limits are reached (i.e., full value of collateral has been borrowed), lenders sometimes provide **stretch financing.** This refers to lending amounts that exceed traditional lending limits. The amount of financing provided above the traditional limit is subject to a higher interest rate and may require the inclusion of an equity kicker.

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4. *Traditional venture capital firms.* When market opportunities are limited, venture capital funds may decide to serve as lenders of mezzanine debt. In addition, mezzanine financing is often needed before a company goes public via its IPO, so some venture capital firms choose to also provide this form of private equity to companies in which they have already invested.

Characteristics of Mezzanine Debt

Mezzanine debt is indeed debt but also has equity-like components because it includes some form of equity participation/appreciation. As a result of its hybrid nature, mezzanine debt has several unique characteristics, including:

1. *Board representation.* Mezzanine lenders often have representation on the board of directors of the firm receiving the funding.

2. *Restrictions on the borrower.* Even though mezzanine debt is unsecured, it may come with borrower restrictions. Mezzanine lenders may have the right to approve additional debt issuances, acquisitions, changes in the management team, or dividend payments.

3. *Flexibility.* There is no set form for mezzanine debt. In other words, it has a flexible structure. Principal repayment is typically deferred for several years.

4. *Negotiations with senior creditors.* Mezzanine investors, the company, and existing creditors of a firm negotiate the subordination of the mezzanine debt in what is known as the **intercreditor agreement**. This agreement prevents terms of the mezzanine financing contained in the credit facility from being changed to allow new agreements between other lenders and the borrower.

5. *Subordination.* There are two types of subordination: blanket and springing. **Blanket subordination** prohibits principal or interest payments to mezzanine investors until senior debt is paid off. **Springing subordination** allows mezzanine investors to receive payments even though senior debt is still outstanding. Once a covenant violation or default occurs, however, the subordination springs up, halting mezzanine payments until the default is fixed.

6. *Acceleration.* If there is a covenant violation, the lender may invoke **acceleration**, which makes the senior debt due and payable immediately. A default would then occur and collateral would be seized.

7. *Assignment.* The senior lenders do not generally permit the mezzanine investor to assign interests to any third parties. If they do permit this, a new intercreditor agreement would be needed.

8. *Takeout provisions.* Once the senior debt has been repaid to a certain level, a **takeout provision** allows the mezzanine investor to take out (purchase) the senior debt, making the mezzanine investor the most senior level of financing for the firm. If the mezzanine lender so chooses, the lender can then take steps to take control of the company by converting debt into equity ownership.

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Distressed Debt

LO 24.2: Demonstrate knowledge of distressed debt as a form of private equity investment.

For example:
- **Recognize characteristics of distressed debt.**
- **Discuss the supply of distressed debt.**
- **Discuss the demand for distressed debt.**
- **Describe the three typical approaches to distressed debt investment.**
- **Describe two major types of corporate bankruptcy processes.**
- **Identify the various terms and standards that relate to bankruptcy processes.**
- **Discuss business risk in the context of distressed debt investing.**

Distressed debt investing is the purchase and/or sale of distressed securities. Investors of distressed debt purchase debt securities in mature firms that are facing financial hardship and may be heading towards or already in bankruptcy. Therefore, potential investors must be reasonably confident that a revised business plan will correct the firm's current issues before investing in distressed debt.

Distressed debt can be distinguished from non-distressed debt by rating, yield, and price measures. Distressed debt generally has a credit rating of CCC (Caa) or lower, yields 1,000 or more basis points above the risk-free rate, and has a price less than half its principal value.

Distressed debt becomes equity-like when equity kickers are attached to the bond. Because distressed debt has default risk, corporate debt with an equity kicker can be equated to the value of a long position in the firm's assets and a short position in a call option on the firm's assets as described below:

corporate debt = firm's assets – call option on firm's assets

In essence, the corporation's debt behaves like a long position in its assets when it falls below the face value of its debt. Note that this equation is also used in regard to mezzanine debt.

Distressed Debt Supply

It is important to understand that distressed debt opportunities are usually the result of a company's actual business plan slowly diverging from its optimal plan over time. As a company increasingly becomes more inefficient and less profitable, it may reach a point where distressed debt investors see an investment opportunity in the potential revitalization of the business.

In an earlier topic review, we examined the five factors that have led to an increase in distressed debt (i.e., new types of commercial loans; active portfolio management; increased debt levels; increased merger, acquisition, and LBO activity; and growth of covenant-light loans).

Failed LBOs present the greatest opportunity for distressed debt investors. Due to the considerable noninvestment grade debt associated with many LBOs, even a slight miscalculation in the strategy can cause the associated debt to become distressed and may

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result in bankruptcy for the new firm. While these situations represent failure for LBO investors, they present opportunities for distressed debt investors.

Distressed Debt Demand

Unlike many investments, distressed debt investors are unable to rely on a consistent quantitative model to select profitable investments. Instead, each investment opportunity is a unique event that must be carefully evaluated for potential challenges. This lack of uniformity combined with the fact that distressed debt is not publicly traded results in an inefficient market.

In addition, because some institutional investors are prohibited from holding noninvestment grade debt, distressed debt investors can earn profits when investment grade debt is downgraded to noninvestment grade. This is because the potential pool of buyers shrinks, leading to the need for sellers to sell their debt for below its intrinsic value.

Similar to other private equity funds, distressed funds manage concentrated portfolios and diversification is not a primary objective. However, distressed debt funds tend to invest in multiple industries, resulting in moderate levels of diversification. Distressed funds also strive to use accurate approaches for estimating default rates, losses given default, and recovery rates. When combined, these figures allow fund managers to better assess the risk inherent in their portfolio and the coupon rate required to justify investment in a particular debt investment.

Example: Required coupon rate

Assume that a distressed debt portfolio has 15% of its investments default every year and the loss rate for defaulted securities is 70%. **Calculate** the minimum required aggregate coupon rate for the portfolio based only on this information.

Answer:

required coupon rate = default rate × loss rate given default

required coupon rate = 15% × 70% =10.5%

Therefore, the required coupon rate for the portfolio to breakeven is 10.5%. In a real world situation, the portfolio manager would need to consider additional factors such as the risk-free rate and the time value of money.

Investment Strategies

Distressed debt investors are typically either looking for a profitable return on their debt investment or seeking to gain an equity stake in the target company at a considerable discount. Distressed debt investing can be classified into three categories: active investors seeking control, active investors not seeking control, and passive investors.

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The characteristics of *active investors seeking company control* include the following:

- Investors actively seek:
  - A blocking position to influence Chapter 11 bankruptcy plans.
  - Equity-for-debt conversion for control of the company.
  - Board of directors' seats and the board chair position.
- Investors purchase more junior debt with high likelihood of equity conversion after a firm emerges from Chapter 11 bankruptcy. These debt issues are known as **fulcrum securities.**
- Investors take an active role in the restructuring and business plans.
- Investors may infuse additional equity after conversion.
- Investors have the highest risk and longest holding period of the three categories.
- Return expectations are 20–25%.

The characteristics of *active investors not seeking company control* include the following:

- Investors have an active role in the restructuring and business plans.
- Investors may accept debt-for-debt conversion or equity-for-debt conversion and equity kickers (i.e., stock warrants).
- Return expectations are 15–20%.

The characteristics of *passive/opportunistic investors* include the following:

- Investors' goal is to earn a short-term return and not necessarily to gain an equity stake in the company.
- Investors buy undervalued debt securities from risk-averse investors.
- Investors may engage in credit arbitrage by buying from investors uninterested in the risk and holding period associated with distressed debt.
- Return expectations are 12–15%.

The Bankruptcy Process

Investors must have a solid understanding of the Chapter 11 bankruptcy process to be successful in the distressed debt market. In a **Chapter 11 bankruptcy**, the debtor firm is reorganized but remains a going concern (i.e., maintains daily operations). The details of the bankruptcy proceedings can be quite complicated, but here we provide an overview of the steps in the Chapter 11 bankruptcy process:

Step 1: The debtor firm files for protection under Chapter 11 of the U.S. Bankruptcy Code. Only the firm itself can file for Chapter 11 protection.

Step 2: The bankruptcy court freezes all default notices from lenders.

Step 3: If the firm has a **prepackaged bankruptcy filing** (i.e., a reorganization plan approved by the lenders in advance of the filing), the firm will seek bankruptcy court approval upon Chapter 11 filing. If successful, this allows the firm to move quickly through the bankruptcy process.

Step 4: If not, the debtor firm must create and file a plan of reorganization within 120 days. A **plan of reorganization** refers to the company's revised business plan that will be implemented after bankruptcy proceedings are complete. The plan includes how bondholders, shareholders, and other creditors will be paid. The **classification of claims** refers to a provision of the bankruptcy code that states that a plan can only place a claim in a class where its claim is similar to the other claims within the class. Under this provision, groups with similar claims (e.g., subordinated debt) are grouped into the same class.

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Step 5: After filing the reorganization plan, the debtor firm has 60 days to convince creditors to accept this plan.

Step 6: For the reorganization plan to be accepted, either the creditor class must be completely unimpaired by the plan (i.e., the class must be paid in full), or 50% in number and two-thirds in dollar amount of claims in the class must vote in favor of the specific reorganization plan. If this occurs, the firm then seeks bankruptcy court approval of the plan. Conversely, to create a **blocking position**, a group must comprise either more than one-half of the claimants or more than one-third of the value of a class. A blocking group can then use its power to support a plan that is more favorable to its claim group.

Step 7: If the 120-day plus 60-day period lapses without an approved plan, any *party of interest* (i.e., the firm's creditors) may submit a reorganization plan to the bankruptcy court.

Step 8: If the debtor firm accepts the alternative plan, bankruptcy court approval is sought.

Step 9: If the debtor firm rejects the alternative plan, the debtor firm submits a new plan and again begins the negotiation process with creditors, or, alternatively, the bankruptcy court can force a **cramdown** in which the court confirms a reorganization plan in spite of claimant objections. However, a plan can only be confirmed if it treats every claimant class fairly, including the classes that object to the plan. Due to the forced nature of cramdowns, they are an infrequent occurrence as creditors realize that a compromised plan will likely lead to superior outcomes.

Debtor-in-possession (DIP) **financing** occurs when a secured lender extends additional credit to a debtor to prevent the debtor from ceasing operations during a Chapter 11 bankruptcy. There are two reasons why a lender will grant DIP financing:

1. It allows the borrower to continue operations.

2. DIP loans have first priority in a Chapter 11 bankruptcy.

Additionally, by granting a DIP loan, the creditor may be able to roll up previous non-DIP loans into the post-petition class to gain first priority in bankruptcy for those loans. Post-petition class loans have priority over prepetition class debt (i.e., debt incurred before the bankruptcy was actually filed).

The **absolute priority rule** refers to the order in which claims are processed in bankruptcies. The first group of claimants is employees, accounts payable, and taxes owed. The second group is debt and bond holders, with senior secured debt holders receiving priority. The last group is the preferred and common shareholders, with preferred shares receiving priority. Distressed debt investors are well versed in absolute priority as it determines their ability to convert their debt into equity and wipe out the existing equity group.

Chapter 7 Bankruptcy

Chapter 7 bankruptcy will occur if a plan of reorganization is not accepted by the creditors of the company and the company is forced to liquidate its assets. If this occurs, the company is no longer a going concern, and the assets are liquidated to repay the debtors in order of absolute priority.

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Business Risk

Business risk is the primary risk of distressed debt investing and is always present. If the firm's business prospects do not improve, the value of the distressed debt may decline further. Distressed debt investors are highly concerned about the firm's ability to execute a solid business plan rather than its creditworthiness. Credit risk is already priced into the debt and, therefore, of little concern to distressed debt investors. These investors are more concerned about the viability of the firm rather than interest or principal payments. As a result, distressed debt investors are more like equity investors than bond investors.

Distressed debt is a fragmented market, and there are few parties that are interested in buying distressed debt. In addition, the eventual payoff is usually long term because workouts and turnarounds take time (i.e., several years). Any sudden liquidity needs are sure to force asset sales at disadvantageous prices.

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Key Concepts

LO 24.1

Mezzanine debt is a hybrid of equity and debt. Because the structure of mezzanine debt is very flexible, a particular issue may be best classified as debt, while a different issue may be best classified as equity.

The most common exit strategy for mezzanine debt is for the investor to be repaid the full face value of the debt by the firm and the value of the stocks or warrants contained in the equity kicker.

In some instances, firms issue mezzanine debt to lower their weighted average cost of capital (WACC). If a company can replace a portion of the expensive equity component with less expensive mezzanine debt, its WACC will be lower. However, the issuance of mezzanine debt typically results in equity investors requiring a higher return to compensate them for the additional risk associated with the issuance of mezzanine debt.

Mezzanine financing is typically used in seven different types of transactions:

1. Management buyouts.
2. Growth and/or expansion.
3. Acquisitions.
4. Company recapitalizations.
5. Commercial real estate financing.
6. Leveraged buyouts.
7. Bridge financing.

The four primary groups of lenders/investors with regard to mezzanine debt include (1) mezzanine funds, (2) insurance companies, (3) traditional senior lenders, and (4) traditional venture capital firms.

Unique characteristics of mezzanine debt include:

- Board representation.
- Restrictions on the borrower.
- Flexibility.
- Negotiations with senior creditors.
- Subordination.
- Acceleration.
- Assignment.
- Takeout provisions.

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LO 24.2

Distressed debt investors purchase the debt of financially troubled companies for a cheap price, initiate a turnaround, and either sell the debt after it recovers its market value or take an equity stake in the company.

Distressed debt opportunities are usually the result of a company's actual business plan slowly diverging from its optimal plan over time. As a company increasingly becomes more inefficient and less profitable, it may reach a point where distressed debt investors see an investment opportunity in the potential revitalization of the business. Failed LBOs present the greatest opportunity for distressed debt investors.

Each distressed debt investment opportunity is a unique event that must be carefully evaluated for potential challenges. This lack of uniformity and lack of public trading results in an inefficient market.

Distressed debt investing can take on three major forms: (1) active investors seeking company control, (2) active investors not seeking company control, and (3) passive/opportunistic investors.

Chapter 11 bankruptcy can be a long, complicated process and includes the following steps:

- Debtor files for protection under Chapter 11 of the U.S. Bankruptcy Code.
- Bankruptcy court freezes default notices from lenders.
- The firm seeks approval of a prepackaged reorganization plan if it exists; if not, the firm must submit a plan within 120 days.
- After filing a plan, the firm has 60 days to gain acceptance by creditors.
- One-half the number and two-thirds the value of each impaired claimant class must accept plan to seek court approval.
- If 120- and 60-day periods pass without a plan, any party of interest may submit a plan that, if accepted by the firm, is submitted for court approval.
- If the firm rejects the alternative plan, it must submit a new plan and seek approval, or, alternatively, the court can force a cramdown.

Chapter 7 bankruptcy will occur if a plan of reorganization is not accepted by the creditors of the company, and the company is forced to liquidate its assets in order of absolute priority.

Business risk is always present in distressed debt investing. If the firm's business prospects do not improve, the value of the distressed debt may decline further. Vulture investors are primarily concerned about the firm's ability to execute the revised business plan rather than the firm's creditworthiness.

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Concept Checkers

1. Mezzanine financing is high risk. Therefore, the total return expectations for mezzanine financing are typically:
   A. 5–9%.
   B. 10–14%.
   C. 15–20%.
   D. 21–25%.

2. Which of the following is *most likely* correct when comparing mezzanine financing, high-yield bonds, and leveraged loans?
   A. Leveraged loans are fixed rate, while high-yield bonds and mezzanine debt are floating rate.
   B. Maturities for leveraged loans are the longest followed by mezzanine debt and then high-yield bonds.
   C. Leveraged loans are unsecured, while high-yield bonds and mezzanine debt have a claim on the borrower's assets.
   D. The recovery rates in default are highest for leveraged loans followed by high-yield bonds and then mezzanine debt.

3. Which of the following statements regarding the characteristics of mezzanine debt is *least accurate*?
   A. Mezzanine debt typically offers a lower permissible loan-to-EBITDA multiple than a bank loan.
   B. Mezzanine debt may be issued in an attempt by a firm to lower its weighted average cost of capital.
   C. Mezzanine lenders often have representation on the board of directors of the firm receiving the funding.
   D. Mezzanine lenders often have the right to approve additional debt issuances, acquisitions, changes in the management team, or dividend payments.

4. In mezzanine financing, there are various restrictions on the senior creditor and mezzanine investor, which may be included in the intercreditor agreement. One of these possible restrictions is subordination. What are the two types of subordination?
   A. Acceleration and drawdown.
   B. Drawdown and assignment.
   C. Blanket and springing.
   D. Springing and acceleration.

5. In a Chapter 11 bankruptcy, what constitutes acceptance of a plan of reorganization by impaired creditor classes?
   A. 90% of the specific impaired creditor class must be paid in full.
   B. 50% in the number and two-thirds of the dollar amount of claims in each impaired creditor class must vote in favor of the plan.
   C. Full approval by the entire impaired creditor class is required, and a dissenting vote can block the entire plan.
   D. In order to be accepted, 75% of each impaired creditor class must vote in favor of the plan.

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Concept Checker Answers

1. **C** The expected total return for mezzanine financing is typically 15–20%. The coupon payment is the largest part of this return and is generally 8–14%. (LO 24.1)

2. **D** The recovery rates in default are highest for leveraged loans followed by high-yield bonds and then mezzanine debt. Leveraged loans are floating rate, while high-yield bonds and mezzanine debt are fixed rate. Leveraged loans are secured, while high-yield bonds and mezzanine debt are unsecured. The terms for high-yield bonds are the longest followed by mezzanine debt and then leveraged loans. (LO 24.1)

3. **A** Mezzanine debt covenants generally allow a maximum loan-to-EBITDA multiple of 4.0–4.5, whereas bank and senior loans only allow a maximum ratio of 2.0–2.5. (LO 24.1)

4. **C** There are two types of subordination. Blanket subordination prohibits principal or interest payment to the mezzanine investor until senior debt is paid off. Springing subordination happens when the mezzanine investor receives payments and there is still senior debt outstanding. If a covenant is violated or a default occurs, these payments stop—the subordination springs up, and the payments stop until the default is fixed. (LO 24.1)

5. **B** For the reorganization plan to be accepted, either the creditor class must be completely unimpaired by the plan (class must be paid in full), or 50% in number and two-thirds in dollar amount of claims. (LO 24.2)

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The following is a review of the Structured Products principles designed to address the learning objectives set forth by the CAIA Association®.

Introduction to Structuring

Topic 6.1

Exam Focus

In this topic review, we begin by defining financial structuring and discuss its role in the markets. The discussion then moves to the different types of structured products and how they are affected by changes in financial trends. Be sure you can perform the required calculations related to simple tranche payments for sequential-pay collateralized mortgage obligations (CMOs). Additionally, we look at structural models for credit risk. Pay particular attention to how both debt and equity can be modeled using equity since this concept reappears later in the topic review. Finally, this topic review introduces collateralized debt obligations (CDOs), providing a brief discussion of the CDO cash flow waterfall and attachment and detachment points.

Financial Structuring Basics

LO 25.1: Demonstrate knowledge of financial structuring.

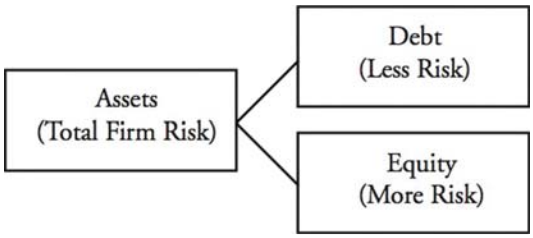
For example:

- **Discuss the relationship between financial structuring and the capital structure of the corporate form of a business organization.**

In finance, **structuring** is a process for creating new securities with differing characteristics (such as risk exposure) from a single investment or from multiple investments.

Corporate capital structure is a common form of financial structuring. It is a method for dividing ownership in the corporation's underlying assets into multiple security types, each with unique characteristics. As shown in Figure 1, corporate capital comes in two basic forms: (1) debt and (2) equity. Each form of capital has a different claim to the corporation's underlying assets and different investment characteristics (debt has lower risk exposure while equity has higher risk exposure). Through financial structuring, investors with different risk and return requirements may invest in the same corporation.

Figure 1: Basic Corporate Capital Structure



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Primary Types of Financial Structuring

LO 25.2: Demonstrate knowledge of the major types of structuring.

For example:
- **Describe the capital structure of a typical business enterprise.**
- **Explain how structured products can be used to design a hedge.**
- **Explain the idea behind tranches.**
- **Discuss two examples of tailoring structured products.**

Corporate Capital Structure

Corporations raise capital in two forms: (1) debt and (2) equity. Within each form, however, there may be many different types of securities, each with their own characteristics. Corporate capital structure is used primarily to divide the risk of the corporation's assets across different types of investors. However, it may also be used to meet different investor needs in terms of time horizon, taxation, returns, and other characteristics.

Structured Products to Design a Hedge

A **credit default swap** (CDS) is a simple form of structured product that helps debt holders manage their credit risk. For a fee, banks will sell debtholders a CDS. Under the CDS, the bank agrees to pay the debtholder if the creditor fails to make payments. In essence, a CDS shifts default risk from the debtholder to the bank. If the creditor defaults, the bank makes the debtholder whole. If the creditor does not default, the bank pays nothing and earns the fee for taking the default risk.

Collateralized Debt Obligations: Allocating Risk with Tranches

A **collateralized debt obligation** (CDO) is a structured security with cash flows that are backed by a pool of debt securities, which could include bonds, loans, or other debt instruments. In order to create a CDO, the issuer packages a series of debt instruments and splits the package into several classes of securities called tranches. Each **tranche** has a different claim on the collateral pool's cash flows and different exposures to the default risk of assets in the pool. These tranches are then sold to investors with differing risk and return goals.

Examples of Tailoring Structured Products

Financial securities can be tailored into many different types of structured products. These products can be targeted to a broad number of investors, or created with a small number of investors in mind.

One specially tailored structured product might be designed for investors looking to avoid the long-term capital gains tax exposure that would result from selling a large equity position. A product that might provide these characteristics for an investor would be a security that guarantees a minimum payout and pays an additional return based on the performance of the equity position, where greater amounts of money are paid if the equity position performs poorly and smaller amounts of money are paid if the equity position performs well. With this product, the investor gets some downside protection should the position perform poorly, but the investor also keeps some upside potential.

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Another specially tailored structured product is a simple CDO involving the corporate bonds of various firms. The CDOs will have several tranches with varying degrees of risk and return. Investors will then be able to select the appropriate tranche to invest in based on their unique investment needs.

Financial Structuring and the Economy

LO 25.3: Demonstrate knowledge of the primary economic role of structuring.

For example:
- **State the primary direct motivation of the issuer.**
- **Discuss how market completion is a motivation for structuring.**
- **Define state of the world.**
- **Discuss how structured products are market completers.**

Market Completion and Economic Motivation

Structured products were created in part to meet investor demand for securities that have characteristics that cannot be met with basic stocks, bonds, or other investments. Economists refer to this action as market completion.

Issuers of structured products seized this opportunity as way to generate additional fees at a time when trading and other commissions began to decline. Investors embraced structured products as a way to meet particular goals in terms of risk/return, taxation, liquidity, and diversification.

In a hypothetical **complete market**, there are enough types of financial securities to meet all investor needs and wants. Market completion is a motivation for structuring because both issuers and investors benefit economically.

Structured Products and States of the World

Complete markets do not exist in the real world. Markets in the real world are considered incomplete because not all participants have equal access to information at the same time. Put simply, in **incomplete markets**, one participant (the buyer or seller) always has better information than the other participant. A **state of the world** is a description of an economic outcome that includes specific values for a large number of important economic variables, such as Treasury bill rates, GDP, unemployment rates, and equity market indices. Different states of the world will lead to different types of incomplete markets and opportunities for issuers to create structured products that move the market state closer to a complete market.

Structured Products in the Role of Market Completers

The possibilities for structured products are endless. Structured products can be created based on any one or more investment classes such as stocks, bonds, commodities, real estate, interest rates, options, market indices, and foreign currencies. Structured products can offer investors different types, levels, and frequencies of cash flows or returns and often include some form of risk transfer or risk enhancement. Structured products work as market completers because they help meet investor demand for securities that are tied to specific risk profiles, return requirements, and market expectations.

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Collateralized Mortgage Obligations (CMOs)

LO 25.4: Demonstrate knowledge of collateralized mortgage obligations (CMOs).

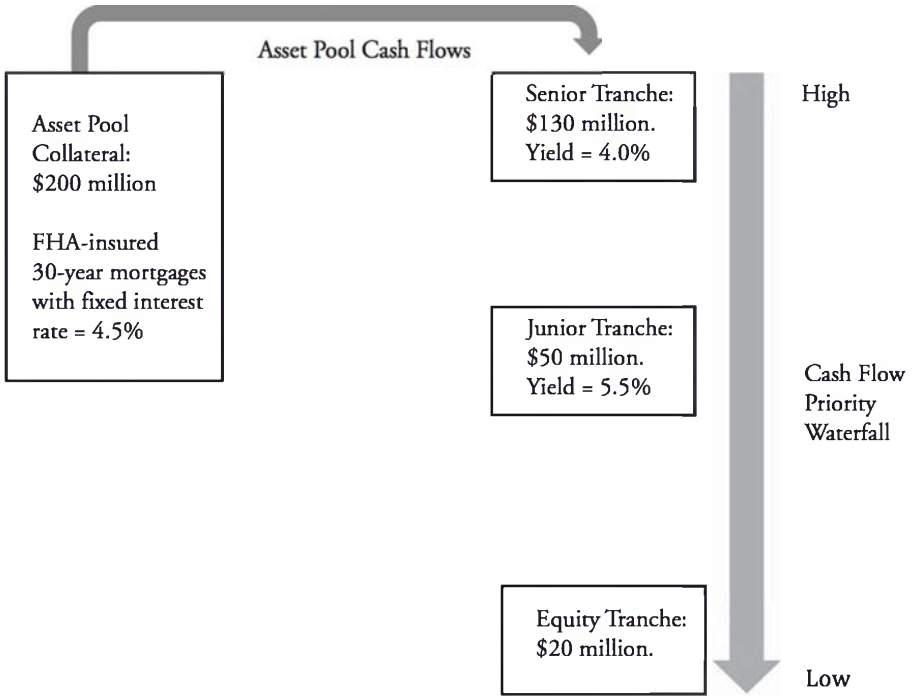
For example:

- **Describe the primary difference between CMOs and other investment pools.**
- **Describe sequential-pay CMOs.**
- **Calculate cash flows to the tranches of a sequential-pay CMO.**
- **Define extension and contraction risk.**
- **Identify and describe other types of CMO structures and tranches (i.e., planned amortization class, targeted amortization class, principal-only, and floating-rate).**
- **List the two motivations for structured mortgage products.**
- **Discuss how interest rates and prepayments impact the valuation of a CMO.**
- **Discuss the role of CMOs in the financial crises of 1994 and 2007.**
- **Describe commercial CMOs and their default risk.**

Collateralized mortgage obligations (CMOs) are a popular form of structured financing for mortgage-based assets. CMOs differ from mortgage pools in that mortgage pools usually only have one type of payout and all investors are eligible for that same payout.

By contrast, the underlying assets for CMOs may include a mix of mortgages of different durations and different types of interest rate structures. CMOs are also highly structured, meaning there are many different types of payouts (tranches) from a single CMO. Figure 2 illustrates a simplified CMO, based on a pool of similar underlying mortgages.

Figure 2: Structure of a Hypothetical Collateralized Mortgage Obligation



Sequential-Pay CMOs

In a **sequential-pay CMO**, when the asset cash flows are received, cash flows first go to pay coupon yields (i.e., interest payments) for each tranche in order of seniority from highest to lowest. Any remaining cash flows are applied to the principal of the most senior tranche first (labeled senior tranche in the previous figure). When the principal is paid off on the senior tranche, this tranche is no longer entitled to any future cash flows. Future incoming cash flows are applied to the coupons of the other tranches (in this case, the junior tranche in the previous figure) and the remaining cash flows are applied to the principal of the next most senior tranche and so on until the principal of the final tranche is paid off.

Example: Calculating the principal payment for a CMO senior tranche

A sequential-pay CMO receives payments once a year. Using the example in Figure 2, how much principal would be paid down for the senior tranche in the first year if the cash inflows total $9 million?

Answer:

The incoming cash flows are applied to the coupons for each tranche in order of priority.

The coupon payment due to the senior tranche is the tranche's periodic coupon rate (4%) multiplied by the size of the tranche ($130 million).

$$\begin{aligned}\text{Senior tranche coupon payment} &= \text{coupon rate} \times \text{tranche principal amount}\\ &= 4\% \times \$130 \text{ million}\\ &= \$5.2 \text{ million}\end{aligned}$$

The coupon payment due to the junior tranche is calculated the same way as the coupon payment for the senior tranche.

$$\begin{aligned}\text{Junior tranche coupon payment} &= \text{coupon rate} \times \text{tranche principal amount}\\ &= 5.5\% \times \$50 \text{ million}\\ &= \$2.75 \text{ million}\end{aligned}$$

The final tranche in this case does not get a coupon payment so total coupon payments are calculated as:

$$\begin{aligned}\text{Total coupon payments} &= \text{senior tranche payment} + \text{junior tranche payment}\\ &= \$5.2 \text{ million} + \$2.75 \text{ million} = \$7.95 \text{ million}\end{aligned}$$

In the sequential-pay CMO in this example, the amount remaining after coupon payments is applied to the principal of the senior tranche.

$$\begin{aligned}\text{Principal payment to senior tranche} &= \text{total payment received} - \text{coupon payments made}\\ &= \$9 \text{ million} - \$7.95 \text{ million}\\ &= \$1.05 \text{ million}\end{aligned}$$

In year one, the senior tranche would get a principal payment of $1.05 million.

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As the principal amount of the senior tranche is reduced, so is its coupon payment. So at the end of year one, the principal amount of the senior tranche would be $128.95 million ($130 million – $1.05 million = $128.95 million).

Therefore, in year two, the coupon payment to the senior tranche would be the coupon rate (4%) multiplied by the new principal amount ($128.95 million) or $5.16 million.

Extension and Contraction Risk

CMOs are structured based on mortgage prepayment assumptions. The price, yield, and value of the CMO are calculated using these assumptions. However, when prepayments vary from the calculated assumptions, the number of coupon payments a particular tranche receives before its principal is paid off may change.

Extension risk is defined as an increase in the expected longevity for a particular tranche. Extension risk is most likely to occur when interest rates rise. In an environment of rising interest rates, borrowers are less likely to prepay their mortgages because there is no economic benefit to refinancing. If fewer mortgages than expected are refinanced, the CMO receives principal from mortgage payoffs later than initially predicted and it takes longer to pay off the principal of the highest tranche as well as the lower tranches.

Contraction risk is the opposite of extension risk. It is defined as a decrease in expected longevity for a particular tranche. Contraction risk is most likely to occur when interest rates fall. If interest rates fall, borrowers are more likely to refinance their mortgages. In this case, the CMO receives principal from mortgage payoffs earlier than initially predicted and each of the tranches is paid off more quickly than expected.

Other CMO Types

The sequential pay structure is only one type of CMO. Many different payment structures can be applied to CMOs. Other major types of CMOs and tranches are: planned amortization class tranches, targeted amortization class tranches, principal-only and interest-only CMOs, and floating-rate tranches.

Planned amortization class (PAC) tranches: In a CMO using PAC tranches, principal repayments are made based on a set of rules. For example, if mortgage prepayments accelerate beyond a certain level, the rules may call for a portion of those prepayments to be shifted to different tranches. However, if prepayments fall below a certain level, the priority of principal payments may change again. As a result, PAC tranche CMOs tend to have higher risk than sequential-pay CMOs and are more difficult to evaluate.

Targeted amortization class (TAC) tranches: TAC tranches are similar to PAC tranches but are more complex. TAC tranches tend to have more triggers at which principal (and sometimes interest) payment priorities change. As a result, the TAC tranche CMOs have even higher risk than both sequential-pay CMOs and PAC tranches.

Principal-only tranches and interest-only tranches: While investors in sequential-pay, PAC, and TAC CMOs receive both principal and interest payments, a CMO may also be structured with **principal-only** (PO) and **interest-only** (IO) tranches.

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PO tranches receive payments from the principal portion of the mortgage payments. Payments to these tranches start off low, when mortgage payments are primarily interest, but then rise as the mortgages age and are eventually paid off. Any mortgage prepayments are applied to the PO tranches as well. If prepayments are lower than expected, cash flows to PO tranches occur further into the future, which decreases the value of these tranches.

IO tranches receive only the interest portion of mortgage payments. Payments to these tranches start off high when mortgage payments are primarily interest and then decline as mortgages are paid off. The values of IO tranches decline when prepayments accelerate because they do not receive any principal payments and because the principal is being paid down, which reduces and shortens the stream of interest payments.

Floating-rate tranches: Floating-rate tranches are usually issued for adjustable-rate mortgage pools. In these tranches, the interest portion of the tranche payment is based on an interest rate index, such as the London Interbank Offered Rate (LIBOR). As interest rates change, the stream of cash flows will either increase or decrease depending on whether interest rates rise or fall. Floating-rate tranche payments are also affected by the rate of mortgage prepayments.

These tranches can be further engineered to provide coupon rates that change at a faster or slower rate than the underlying index. When a floating-rate tranche is structured so that the coupon rate rises when interest rates fall and vice versa, it is called an **inverse floater tranche.**

Motivations for Investing in Structured Products

Investors use structured products to (1) reduce risk and (2) enhance returns.

Investors interested in risk reduction use structured products to tie the expected cash flows from their investment to their cash needs (liability-matching). For some investors, the 30-year time horizon for a mortgage pool is simply too long and the range of prepayment outcomes is too broad. Structured products enable investors to select their tranches based on their cash flow needs and prepayment sensitivities—put simply, the investors' risk/return preferences.

Investors use structured products to enhance returns when they believe they have better information than the market. These investors look for structured products that are mispriced based on the investors' outlook for interest rates or prepayment trends. In this case, the investors seek to outperform the market by taking advantage of the sensitivity of CMO values to extension and contraction risk.

Valuing CMOs in a Default-Free Environment

As discussed above, CMO values are sensitive to interest rate and prepayment trends. However, when prepayment or interest rates change, the value of individual tranches may change more or less than the value of the underlying collateral (mortgage pool). The amount of the value change will depend on several factors, including duration, sensitivity to prepayment rates, and specific tranche rules.

As a rule, tranches with longer durations will be more affected by a change in interest rates than those with shorter durations. Therefore, junior and equity-only tranches will change in value more than senior tranches.

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IO tranches are most sensitive to changes in interest rates. A 1% increase in interest rates would likely change the value of IO tranches by a multiple of that percentage. Depending on the tranche rules, the value of the IO tranche will likely rise as prepayments slow, extending the longevity of the coupon payment stream.

Given a 1% increase in interest rates, PO tranches would likely decrease in value, but to a more modest extent because prepayments will likely slow. TAC tranches are also highly sensitive to interest rates because small changes in these rates can trigger significant changes in tranche payments. PAC tranches are also sensitive to interest rates, but less so than TAC and IO tranches. In the end, valuing tranches can be extremely complex due to the range of products, payment rules, underlying prepayment models, and other factors.

CMOs in the Financial Crises of 1994 and 2007

The availability of complex CMOs has historically outstripped the market's ability to effectively value them. As a result, when there is a sudden, significant change in one or more of the factors affecting CMOs, particularly interest rates, prepayment rates, and default rates, market liquidity may dry up and values may fall.

In 1994, the U.S. Federal Reserve raised interest rates sharply when it decided the economy was growing too quickly. Investors holding CMOs saw the value of their tranches fall dramatically and in many cases to a greater extent than anticipated because investors did not fully understand the terms of their tranche payments. This lack of understanding created a vicious cycle where values fell and liquidity dried up, fueling further declines in values. Inverse floating-rate TAC tranches were hit particularly hard due to the number of triggers that effectively changed tranche payments quickly and dramatically.

Structured products were again front and center in the financial crisis that began in 2007. Investors were surprised by a huge increase in default rates. Banks were originating ever more complex mortgages to a less creditworthy pool of borrowers. Because the banks subsequently sold these mortgages, which were repackaged (securitized) into CMOs to be sold to investors, the banks were not particularly invested in the long-term outlook for these mortgages. At the same time, investors were eager to find products that could enhance their returns and piled into CMOs not knowing exactly what was in the mortgage pools. The result was a repeat of the 1994 financial crisis—values fell as investors struggled to understand the impact of defaults on their particular tranches, and liquidity dried up and drove a downward spiral.

Default Risk and Commercial CMOs

For most CMOs based on a pool of residential mortgages, prepayment is usually the primary risk for investors. When the CMOs are based on commercial mortgages, default risk is more of a concern. In these cases, the CMOs are often structured so that the seniority of the tranche is tied to its default risk exposure.

Default risk is usually based on the credit rating of the underlying borrowers. Unlike residential borrowers, the credit rating of a commercial borrower may be more difficult to determine accurately because a commercial enterprise may be more sensitive to economic changes as well as management's ability to run the business.

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Structural Approach to Credit Risk Modeling

LO 25.5: Demonstrate knowledge of the structural approach to credit risk modeling.

For example:
- **Recognize the optionlike nature of structured cash flows.**
- **Recognize the intuition of Merton's structural model.**
- **Apply the call-option and the put-option views of capital structure.**
- **Discuss the inherent conflict of interest between stockholders and bondholders.**
- **Define and apply put-call parity.**
- **Describe how the Black-Scholes option pricing model can be used to estimate the value of debt that contains credit risk.**
- **Discuss binomial tree models as an alternative to the Black-Scholes option pricing model.**
- **Discuss advantages and disadvantages of structural credit risk models.**

Structural credit risk models allow investors to better understand credit risk and the factors that drive default by analyzing the firm's capital structure. These structural models use option theory to estimate credit risk as a function of the value of the firm. Given the value of the firm, the value of debt and equity can then be determined. The value of debt can serve as an indicator of the firm's default risk.

A firm's debt and equity may be viewed as options. Take a hypothetical firm that issues only two securities: one class of non-dividend paying equity and a single zero-coupon debt issue. The firm's equity can be viewed as a call option on the firm's assets. The assets of the firm are the underlying, the strike price is the face value of the firm's debt, and the expiration date of the option is the maturity date of the debt. If the firm performs well, it pays the debtholders at maturity and the equity owners take ownership of all of the assets. If the firm performs poorly, the equity owners declare bankruptcy and leave the debtholders the assets of the firm.

With this view of the capital structure, owning the equity of the firm is equivalent to owning a call option on the assets of the firm, and owning the debt is equivalent to owning the assets and writing a call option. With this framework, it is possible to price the firm's securities using an option pricing model such as the **Black-Scholes option pricing model** given inputs such as asset volatility and interest rates.

In a real world application, estimation of the inputs to the Black-Scholes model has several challenges, including:

- Capital structures are generally more complicated than the assumed issuance of a single discount bond and a single non-dividend paying equity.
- The underlying (the firm's assets) is not continuously traded. It is difficult to determine the value of the firm's assets, and the value may have to be derived using the value of the firm's securities. This creates a circular reasoning problem, given that the model is being used to value the firm's debt.
- The lack of trading for the firm's assets also means the volatility of the assets is not observable. A potential solution is to use the volatility of the firm's equity, adjusting for leverage.

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It is also possible to model a firm's capital structure using put options instead of call options. **Put-call parity** illustrates that equivalent positions can be created using puts and calls given that the puts and calls have the same underlying asset, strike price, and expiration date. Put-call parity can be represented as:

assets – call = risk-free bond – put

Again, we can assume the assets of the firm are the underlying, the strike price is the face value of the firm's debt, and the expiration date of the option is the maturity of the debt.

Using the call option to represent the firm's equity securities, the firm's debt equals its assets minus the call. Thus, from put-call parity:

firm's debt = risk-free bond – put

firm's equity = assets + put – risk-free bond

The firm's risky debt, therefore, has two equivalent representations:

1. A covered call position on the firm's assets (i.e., assets – call). This is known as the **call option view of capital structure.**

2. Owning risk-free debt and writing a put option on the firm's assets (i.e., risk-free bond – put). This is known as the **put option view of capital structure.**

Merton's Structural Model

Merton's structural model is formed such that a firm's risky debt is the combination of owning risk-free debt and writing a put option on the firm's assets. If the firm does well, the put expires out-of-the money, and the debtholder receives the principal on the risk-free debt plus the put premium, which represents the credit premium for facing credit risk. If the firm does poorly, the put expires in-the-money. The debtholder still receives the principal on the risk-free debt plus the put premium but must purchase the assets of the firm at the strike price (i.e., the face value).

Example: Calculating the implied put price using the Merton model

Consider two pure-discount bonds with face values of $1,000 and one year to maturity: one risk free and the other risky. The risk-free bond is priced at $943.40 with a yield of 6% and the risky bond is priced at $925.93 with a yield of 8%. **Calculate** the value of the implied put option on the risky bond issuer's assets.

Answer:

The value of the implied put option is the difference between the prices of the risky and risk-free bonds, or $17.47 (= $943.40 – $925.93).

Conflict of Interest Between Shareholders and Bondholders

Given that options increase in value as volatility increases, we can infer from the option representations of the firm's capital structure that equity holders and bondholders have conflicting interests in the volatility of firm assets. Equity holders, who are long volatility, want higher volatility. Debtholders, who are short volatility, want lower volatility.

Valuing Risky Debt

Using the Black-Scholes model to value debt involves the following four-step process.

1. **Estimate the equity volatility of the corporation.** This is typically accomplished by examining historical stock volatility, implied option volatility, or a combination of both stock and option volatility.

2. **Calculate the firm's asset value by unlevering the firm's estimated equity volatility.** In this step, the following formula is utilized:

   $\sigma_{assets} \approx \sigma_{equity} \times$ (equity value / asset value)

3. **Determine the value of the call and put option on the firm's assets.** This is accomplished by using the Black-Scholes option pricing model.

4. **Calculate the value of the firm's risky debt.** By inserting the put and call option values into Merton's structural model, the value of the firm's debt can be calculated.

The above process makes the following assumptions: (1) the firm only has a single debt issue that pays no coupon, (2) estimates of the firm's assets are accurate, and (3) any changes in the value of the firm's assets will be lognormally distributed in percentage terms. If any or all of these assumptions are violated, the value of the risky debt may be inaccurate.

Example: Valuing corporate debt with the Black-Scholes model

A firm has $500 million in assets and $300 million in equity value. Debt issued by the firm has a face value of $210 million. The firm's estimated equity volatility is 30%. If the estimated equity volatility increases to 60% due to changing market conditions, what is the firm's current unlevered asset volatility?

Answer:

$\sigma_{assets} \approx \sigma_{equity} \times$ (equity value / asset value)

$\sigma_{assets} \approx 60\% \times (\$300 / \$500) = 36\%$

Professor's Note: Using the calculated asset volatility, call and put prices could be determined using the Black-Scholes model, which could then be used to calculate the new value of the firm's debt. However, due to the complexity of these calculations, they are not part of the knowledge required to master this learning objective.

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The Binomial Approach

The **binomial approach** to pricing risky debt is based on the risk-neutral pricing framework and uses two binomial trees (described in an earlier topic review) to determine the appropriate valuation: a tree to determine asset values and a tree to determine interest rates. Relative to the Black-Scholes option pricing model, the binomial approach can handle more complex structured products.

Advantages and Disadvantages of Structural Models

Advantages of structural models:

- Fixed-income securities can be priced using equity market data, which is reliable and easily obtainable.
- The model is flexible enough to price related fixed-income securities such as convertibles or different seniority issues.

Disadvantages of structural models:

- Distortions in equity prices (e.g., bubbles) will misprice fixed-income securities. Thus, we must be confident that asset values derived from equity prices are reasonable.
- Data on firm liabilities may be unavailable due to an issuer's lack of transparency and accounting choices.
- Computed values from simple models might not be meaningful for very short-term and very high-quality debt, or for debt that is likely to default.

Structuring Using Collateralized Debt Obligations

LO 25.6: Demonstrate knowledge of the concept of structuring cash flows using collateralized debt obligations (CDO).

For example:
- **Define and explain various tranches of a CDO.**
- **Discuss attachment points and detachment points.**
- **Calculate cash flows to different tranches of a CDO in the case of defaults of the underlying instruments.**
- **Define a bull call spread and a bull put spread.**
- **Explain the relationship between option spreads, mezzanine tranches, and other tranches.**

A typical CDO pools collateral in the form of debt instruments and issues senior, mezzanine, and equity claims (i.e., the tranches) against the cash flows from the underlying collateral. Tranches have implicit credit protection from lower rated tranches. The **senior tranche** is the safest tranche and usually carries an AAA credit rating. The **mezzanine tranche** is a slightly more risky tranche leading to a lower credit rating. The **equity tranche** is the most risky tranche as it is the first to incur any losses. The equity tranche is unrated.

In Figure 3, the CDO trust's collateral pool contains $200 million of high-yield bonds that were purchased using the cash from the sale of CDO securities. The CDO securities include:

- A $160 million senior tranche that is AAA rated and has a stated coupon of 4%.
- A $30 million mezzanine tranche that is BB rated and has a stated coupon of 7%.
- A $10 million equity tranche that is unrated.

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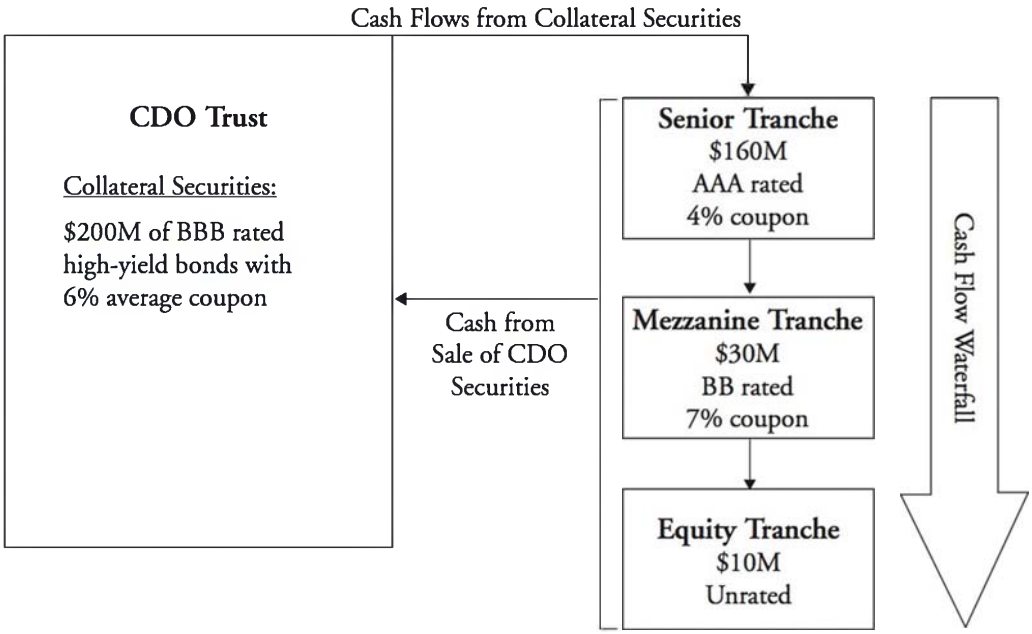
Figure 3: Structure of a Hypothetical CDO



The cash from the collateral securities is paid to the CDO securities based on seniority in what is known as the cash flow waterfall. In this example, the high-yield bonds would pay interest of $12 million annually, assuming no default, which would fund fees and expenses and then pay the interest on the CDO securities, with the residual going to the equity tranche. In our example, the annual interest payment to the senior tranche would be $6.4 million and the payment to the mezzanine tranche would be $2.1 million. Ignoring the fund fees and expenses, the amount available to pay to the equity tranche would be $3.5 million (= $12 million – $6.4 million – $2.1 million).

What happens when there are defaults in the CDO's collateral pool? The order of losses is opposite that of the cash flow waterfall. The equity tranche is commonly referred to as the first loss tranche because it is the first to absorb any losses from the debt securities in the pool. Subsequent losses are absorbed by the mezzanine tranches, making the senior tranche the last in line to have any loss exposure. In the hypothetical CDO, a loss of $15 million would wipe out the equity tranche and reduce the value of the mezzanine tranche from $30 million to $25 million. The reduction to the mezzanine tranche value also results in lower interest payments. The annual interest payments fall from $2.1 million to $1.75 million.

Attachment and Detachment Points

Attachment and detachment points describe the size and position of each tranche relative to the entire CDO and give an indication of a tranche's loss position. A tranche's **attachment point** (also called the **lower attachment point**) indicates the minimum percentage loss in CDO collateral that will begin to reduce the value of the tranche. The tranche's **detachment point** (also called the **upper attachment point**) indicates the percentage loss in CDO collateral that would result in total loss of the tranche's value. In the hypothetical CDO shown in Figure 3, the lower attachment point for the mezzanine tranche is 5% and the detachment point is 20%. Therefore, this mezzanine tranche could be called a 5%/20% mezzanine tranche.

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Option Models for CDO Tranches

As with the debt and equity securities of a firm, it is possible to model the tranches of a CDO using options.

- The senior tranche can be modeled in the same manner as the debt of a firm—as a covered call position or as a risk-free bond and a short put.
- The equity tranche can be modeled in the same ways as the equity of a firm—a call option or a financed long position in the underlying combined with a long put.

The mezzanine tranche is more complicated because it depends on credit losses within a range (the attachment and detachment points). Thus, it takes two options to model a mezzanine tranche. These tranches can be modeled as a bull call spread, a bull put spread, or a collar.

- A **bull call spread** contains a long call position with a lower strike price and a short call position with a higher strike price. The senior tranche can also be modeled as a bull call spread with a long call that has a strike of $0 and short call with a positive strike. The long call with a strike of $0 is equivalent to owning the underlying, so this position is equivalent to a covered call. Puts can also be used to replicate the payoffs for a bull call spread.
- In a **bull put spread**, the investor sells a put with a higher strike price and buys a put with a lower strike price.
- In a **collar**, the ownership of a risky asset (i.e., the underlying pool of assets) is combined with a long position in a put option on the underlying asset and a short position in a call option on the underlying asset. The premium received for the call option at least partly offsets the premium paid for the put option. A collar strategy imposes a limit on both upside and downside potential.

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Key Concepts

LO 25.1

Structuring is a process for creating new securities with differing characteristics (such as risk exposure) from a single investment or number of investments.

Corporate capital structure is a common form of financial structuring. It is a method for dividing ownership in the corporation's underlying assets into securities, each with differing characteristics.

LO 25.2

Corporations raise capital in two forms: (1) debt and (2) equity. Within each form, there are many different types of securities, each with its own characteristics.

A credit default swap (CDS) is a simple form of structured product that helps debtholders manage their credit risk. A debtholder buys a CDS from a bank. Under the CDS, the bank agrees to pay the debtholder if the creditor fails to make payments. In essence, a CDS shifts default risk from the debtholder to the bank.

A structured security organizes different levels of risk in a pool of debt securities into distinct categories called tranches. Each tranche consists of a particular set of ownership claims to the cash flows and principal payments of the debt securities pool. Tranches are then sold to investors with differing risk/return goals.

An example of tailoring a structured product would be a security that pays higher amounts if an equity position performs poorly and lower amounts if an equity position performs well. A collateralized debt obligation (CDO) is another example of tailoring a structured product.

LO 25.3

Structured products were created in part to meet investor demand for securities that have characteristics that cannot be met with basic stocks, bonds, or other investments. Economists refer to this action as market completion.

Market completion is a motivation for structuring because both issuers and investors benefit economically. Issuers of structured products generate additional fees. Investors buy structured products to meet particular goals in terms of risk/return, taxation, liquidity, and diversification.

In incomplete markets, one participant (the buyer or seller) always has better information than the other participant. Real world markets are incomplete because not all participants have equal access to information at the same time. A state of the world is a description for incomplete markets that includes specific values for a large number of economic variables, such as Treasury bill rates, GDP, unemployment rates, and an equity market index.

Structured products work as market completers because they help meet investor demand for securities that are tied to a specific risk profile, return requirements, and market expectations.

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LO 25.4

CMOs differ from mortgage pools because mortgage pools usually only have one type of payout and all investors are eligible for that same payout.

In a sequential-pay CMO, cash flows first pay coupons to each tranche in order of seniority (high to low). Any remaining cash flows are applied first to the principal of the senior tranche. When the principal is paid off on the senior tranche, it is no longer entitled to any cash flows. Future incoming cash flows are applied to the coupons of the other tranches and the remaining cash flows are applied to the principal of the next highest tranche and so on until the principal of the final tranche is paid off.

Extension risk is defined as an increase in the expected longevity of a particular tranche and is most likely to occur when interest rates rise.

Contraction risk is defined as a decrease in expected longevity of a particular tranche and is most likely to occur when interest rates fall.

Other major types of CMO tranches include:

- Planned amortization class (PAC) tranche: In a CMO using PAC tranches, principal repayments are made based on a set of rules. For example, if mortgage prepayments accelerate beyond a certain level, the rules may call for a portion of those prepayments to be shifted to different tranches.
- Targeted amortization class (TAC) tranches are similar to PAC tranches but more complex. TAC tranches tend to have many more triggers at which principal (and sometimes interest) payment priorities change.
- Principal-only (PO) and interest-only (IO) tranches. PO tranches receive payments that are equal to the principal portion of the mortgage payments plus any principal prepayments. IO tranches receive only the interest portion of mortgage payments.
- Floating-rate tranches are usually issued for adjustable-rate mortgage pools. In these tranches, the interest portion of the tranche payment is based on an interest rate index such as the London Interbank Offered Rate (LIBOR). An inverse floater tranche is a floating rate tranche structured so that the coupon rate rises when interest rates fall and vice-versa.

Investors use structured products to reduce risk and to enhance returns.

- Risk reduction: Investors use structured products to tie the expected cash flows from their investment to their cash needs (liability-matching).
- Return enhancement: Investors use structured products to enhance returns when they believe they have better information than the market.

CMO values are sensitive to interest rate and prepayment trends. When prepayment or interest rates change, the value of individual tranches may change more or less than the value of the underlying collateral. The amount of the value change depends on several factors including duration, sensitivity to prepayment rates, and specific tranche rules.

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The availability of complex CMOs has historically outstripped the market's ability to effectively value them. When there is a sudden, significant change in one or more of the factors affecting CMOs, market liquidity may dry up and values may fall.

- In 1994, a sizeable interest rate increase disrupted the structured products market as well as the broader markets.
- In 2007, higher than expected mortgage default rates on CMOs disrupted the financial markets.

When CMOs are based on commercial mortgages, default risk is more of a concern. The credit rating of a commercial borrower may be difficult to determine because a commercial enterprise may be more sensitive to economic changes as well as management's ability to run the business.

LO 25.5

A simple structural model can be used to price both the debt and equity claims on the firm's assets using option pricing theory, where equity is modeled as a call option and debt is modeled as a covered call.

In Merton's structural model, debt is modeled as a risk-free bond and writing a put option. By put-call parity (assets – call = risk-free bond – put), this is equivalent to modeling debt as a covered call. Corporate debt valuation utilizing the Black-Scholes model requires four steps:

1. Estimate the equity volatility of the corporation using historical or option volatility.

2. Calculate the firm's asset value by unlevering the firm's estimated equity volatility.

3. Determine the value of the call and put option on the firm's assets using the Black-Scholes option pricing model.

4. Calculate the value of the firm's risky debt using Merton's structural model.

Because equity holders are effectively long an option and debt holders are effectively short an option, these two groups of investors have an inherent conflict of interest with regard to the volatility of the underlying assets.

The binomial approach to pricing risky debt is based on the risk-neutral pricing framework and uses two binomial trees to determine the appropriate valuation: a tree to determine asset values and a tree to determine interest rates.

Advantages of structural models:

- Fixed-income securities can be priced using equity market data, which is reliable and easily obtainable.
- The model is flexible enough to price related fixed-income securities such as convertibles or different seniority issues.

Disadvantages of structural models:

- Distortions in equity prices (e.g., bubbles) will misprice fixed-income securities. Thus, we must be confident that asset values derived from equity prices are reasonable.

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- Data on firm liabilities may be unavailable due to an issuer's lack of transparency and accounting choices.
- Computed values from simple models may not be meaningful for very short-term and very high-quality debt, or for debt that is likely to default.

LO 25.6

A CDO pools collateral in the form of debt instruments and issues senior, mezzanine, and equity tranches against the cash flows from the underlying collateral. The order of the cash flow waterfall is senior, mezzanine, and then equity. In the event of a loss, the tranches realize losses in reverse order from the cash flow waterfall (i.e., the equity tranche absorbs losses first).

An attachment point (or lower attachment point) is the minimum percentage loss in CDO collateral that will begin to reduce the value of a tranche. A detachment point (or upper attachment point) is the percentage loss in collateral that would result in total loss of a tranche's value.

CDO tranches can be modeled using options, similar to the modeling of a firm's capital structure using a structural model. The equity tranche can be modeled as a call option or a financed equity position with a long put option. The mezzanine tranche can be modeled as a bull call spread (long call with lower strike + short call with higher strike), bull put spread (short put with higher strike + long put with lower strike), or as a collar (long put + short call). The senior tranche can be modeled as a covered call or a risk-free debt security with a short put option.

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Concept Checkers

1. Which of the following is **NOT** an example of financial structuring?
   A. Corporate capital structure.
   B. Collateralized mortgage obligations (CMO).
   C. Forward contract on gold prices.
   D. Floating-rate tranche.

2. Why would an investor purchase a credit default swap (CDS)?
   A. Enhance returns.
   B. Transfer risk.
   C. Earn a fee.
   D. Match cash flows to liabilities.

3. Which of the following is a motivation for creating structured products? Structured products:
   A. reduce costs to issuers.
   B. are less expensive for investors to buy and trade.
   C. improve the state of the world.
   D. improve market completeness.

4. What type of CMO tranche is *most likely* to increase in value when interest rates increase?
   A. Floating-rate tranche with five years to maturity.
   B. Senior tranche of sequential-pay CMO with 10 years to maturity.
   C. Principal-only tranche with two years to maturity.
   D. Equity-only tranche of a Planned Amortization Class (PAC) CMO with one year to maturity.

Use the following information to answer Questions 5 and 6.

The collateral pool for a sequential-pay CMO has $200 million in insured 30-year fixed rate residential mortgages with an average coupon of 5.25%. The CMO has issued the following securities:

Senior tranche: $170 million, 3.5% coupon.
Junior tranche: $30 million, 6% coupon.
Cash flows in month one = $5.75 million
Cash flows in month two = $5.15 million

5. The principal payment made to the senior tranche in month one is *closest* to which of the following?
   A. $0.
   B. $0.7 million.
   C. $5.1 million.
   D. $5.3 million.

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6. The interest payment to the junior tranche in month two is *closest* to which of the following?
   A. $3.6 million.
   B. $0.15 million.
   C. $0.63 million.
   D. $0.7 million.

Use the following information to answer Questions 7 through 9.

The collateral pool for a CDO has $50 million in high-yield bonds with an average credit rating of BB and an average coupon of 8%. The CDO has issued the following securities:

Senior tranche: $30 million, AA rated, and 4% coupon.
Mezzanine tranche: $15 million, B rated, and 9% coupon.
Equity tranche: $5 million, unrated.

7. Ignoring fees and expenses and assuming no defaults, the annual payment to the equity tranche is *closest* to:
   A. $0.0 million.
   B. $1.2 million.
   C. $1.5 million.
   D. $4.0 million.

8. The lower attachment point on the mezzanine tranche is *closest* to:
   A. 0%.
   B. 5%.
   C. 10%.
   D. 40%.

9. Which of the following portfolios would *best* model the mezzanine tranche?
   A. A long call option with a $0 strike and a short call option with a $30 million strike.
   B. A long call option with a $30 million strike and a short call option with a $45 million strike.
   C. A risk-free bond with face value of $50 million and a short put option with a strike of $30 million.
   D. The underlying $50 million collateral portfolio and a short call option with a strike of $30 million.

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Concept Checker Answers

1. **C** A forward contract on gold is not considered a structured product because most forward contracts do not include a substantially altered exposure to the characteristics of the underlying asset. The other choices are all considered structured products (LO 25.1)

2. **B** A credit default swap transfers default risk from the debt holder to the bank or other issuer. A CDS primarily reduces downside risk due to default. Only issuers earn a fee from the CDS. Matching cash flows to liabilities is the function of a tranche. (LO 25.2)

3. **D** Primary motivation for financial structuring is to increase market completeness. Creating structured products is a cost to issuers. Investors pay fees to access structured products in addition to transaction costs. A state of the world is a description of an incomplete market, not a benefit of structured products. (LO 25.3)

4. **A** A floating-rate tranche sees its coupon rate rise when interest rates rise. Therefore, it is the only choice that will rise when interest rates rise. The other choices will likely be flat or down because a rise in interest rates will either cause a decline in prepayments or have little impact on the remaining cash flows. (LO 25.4)

5. **C** The formula for principal paydown is:

   Principal payment to senior tranche = total payment received – coupon payments made

   First calculate the one-month coupon payments to the senior tranche and junior tranche.

   Senior tranche coupon payment = (annual coupon rate / periods per year) × (tranche principal amount)
   = (3.5% / 12) × ($170 million)
   = $0.5 million

   Junior tranche coupon payment = (annual coupon rate / periods per year) × (tranche principal amount)
   = (6% / 12) × ($30 million)
   = $0.15 million

   Total coupon payments are calculated as:

   Total coupon payments = senior tranche payment + junior tranche payment
   = $0.5 million + $0.15 million
   = $0.65 million

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In the sequential-pay CMO in this example, therefore, the amount remaining after coupon payments is applied to the principal of the senior tranche.

Principal payment to senior tranche = total payment received – coupon payments made
= \$5.75 million – \$0.65 million
= \$5.1 million

(LO 25.4)

6. **B** Because the junior tranche does not receive any principal paydown in month one, the coupon payment remains the same in month two as month one.

Junior tranche coupon payment = (annual coupon rate / periods per year) × (tranche principal amount)
= (6% / 12) × (\$30 million)
= \$0.15 million

(LO 25.4)

7. **C** The annual payment to the equity tranche is the residual cash flow from the CDO collateral after making the required payments to the senior and mezzanine tranches. In this case, the residual amount is \$1.45 million or approximately \$1.5 million (= \$50 million × 8% – \$30 million × 4% – \$15 million × 9%). (LO 25.6)

8. **C** The lower attachment point is the minimum percentage loss in CDO collateral that will begin to erode a given tranche. In this case, the equity tranche provides \$5 million or 10% of loss protection to the mezzanine tranche, so the lower attachment point for the mezzanine tranche is 10%. (LO 25.6)

9. **B** The mezzanine tranche can be modeled as a bull call spread with a long call at a lower strike and a short call at the higher strike. In this case, the lower strike is set at \$30 million, which is the size of the senior tranche position. When the CDO collateral exceeds \$30 million in value, the mezzanine tranche will be in the money. The upper strike is set at \$45 million, which represents the senior tranche position plus the mezzanine tranche position. When the value of the CDO collateral is \$45 or greater, the mezzanine tranche will be worth the full \$15 million. (LO 25.6)

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The following is a review of the Structured Products principles designed to address the learning objectives set forth by the CAIA Association®.

Credit Risk and Credit Derivatives

Topic 6.2

Exam Focus

In this topic review, we begin by defining credit risk and discussing its foundations. The discussion then moves on to the two major categories of credit risk models: structural models and reduced-form models. Pay particular attention to expected credit loss since this concept is fundamental to credit analysis. We also examine credit derivatives and the credit derivatives market. Understand the details of credit default swaps and other major credit derivatives (e.g., credit options and credit-linked note). In addition, you must be able to recall many institutional details including International Swaps and Derivatives Association (ISDA) credit event definitions, counterparty risk, mark-to-market, unwinding a position, and basis risk.

Credit Risk

LO 26.1: Demonstrate knowledge of credit risk.

For example:

- **Explain the underpinnings of credit risk.**

Credit risk is the variability in financial outcomes related to firm failure or default. Unlike market risk, which is a systematic risk, credit risk contains idiosyncratic or firm-specific risk. Idiosyncratic risk leads to performance issues for individual securities. The return distribution for market risk is relatively symmetric, with opportunities on both the upside and downside. Credit risk, on the other hand, is skewed to the left. That is, exposure to credit risk in a corporate bond yields a limited upside (the receipt of promised interest payments and the recovery of principal), while the downside risk is the loss of the entire investment from bankruptcy or default.

Default risk is the risk that the issuer of a bond (or debtor on a loan) will not meet the obligations of the issue. The borrower is deemed to be in default if it fails to make a scheduled interest or principal payment. Note that default can be partial or complete. In a partial default, a portion of the outstanding debt is recoverable by the lender. In a complete default, the debtor does not repay any of the amount owed.

Credit spread is an asset's yield over the yield of a risk-free benchmark with similar time-to-maturity. An increase in an asset's spread indicates that the asset will underperform. For example, if the risk-free benchmark trades at 6%, and a credit-risky security trades at 8%, the credit spread is 2%. If the credit spread subsequently increases to 2.5%, the price of the credit-risky asset must have fallen relative to the benchmark security. A credit spread increase is the result of the market reacting to a perceived deterioration in credit quality.

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Both macroeconomic and idiosyncratic changes affect credit spreads. Periods of economic slowdown are associated with larger credit spreads as revenues and earnings decrease, lowering interest coverage ratios. During liquidity crises, credit spreads increase as investors demand greater compensation for holding less-liquid securities. Firm-specific issues that result in declining revenues and earnings will also cause credit spreads to increase as the credit quality of the firm worsens.

In the United States, the credit-risky fixed income market is commonly called the **spread product market** because these securities trade at yields that include a credit spread.

Modeling Credit Risk

LO 26.2: Demonstrate knowledge of approaches to credit risk modeling.

For example:
- **Identify the difference between structural models and reduced-form models.**
- **Define the three factors that determine the expected credit loss of a credit exposure.**
- **Calculate expected credit loss.**
- **Describe two key characteristics of the risk-neutral modeling approach.**
- **Define risk-neutral probability.**
- **Describe and apply the risk-neutral approach to pricing risky debt.**
- **Apply the risk-neutral approach to estimating credit spreads.**
- **Explain what it means to calibrate a model.**
- **List the advantages and disadvantages of the reduced-form model.**
- **Compare structural and reduced-form credit risk models.**

Credit risk stems from the uncertainty of promised repayment. Credit models have emerged to fill market participants' need to accurately measure and manage their credit risk exposures. Other uses for credit models are to price illiquid securities that do not have observable market prices and to attempt to identify arbitrage profit opportunities.

Two Models of Credit Risk

Two main groups of credit models exist:

1. **Structural credit models** value debt securities by analyzing the financial characteristics of the organization that issued the debt security. Structural models incorporate factors including the corporate structure (e.g., debt-to-asset ratio) and the volatility of the firm's assets.

2. **Reduced-form credit models** take a different approach. Rather than explicitly modeling default as a function of borrower-specific characteristics, reduced-form models use the market data for liquid securities to infer the market's expectation of default, which can then be used to price illiquid securities. (i.e., less-liquid securities are priced by using information obtained from the prices of more-liquid securities.) This process is similar to calculating the implied volatility of an option by assuming that the market price of the option is correct and then using the Black-Scholes model to infer the volatility of the option.

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Expected Credit Loss

The expected loss due to credit risk is a function of three components:

- **Probability of default** (PD). The likelihood that the borrower will experience a credit event and not fulfill their contractual obligation.
- **Exposure at default** (EAD). The value of the outstanding debt at the time of default. The EAD for a newly issued loan is only the principal, but later consists of both remaining principal and promised interest.
- **Loss given default** (LGD). The percentage loss to the lender should the borrower default on the obligation. The lender is likely to recover some portion of the investment—this fraction is called the **recovery rate** (*RR*). Note that LGD = 1 – RR.

Putting the three components together, the value of expected credit loss can be calculated as:

$$\text{expected credit loss} = \text{PD} \times \text{EAD} \times \text{LGD}$$

or equivalently:

$$\text{expected credit loss} = \text{PD} \times \text{EAD} \times (1 - \text{RR})$$

Example: Calculating expected credit loss

Northern Yankee Company has received an 8%, one-year, $10 million loan from Big Bank. Interest on the loan is paid at maturity. Big Bank has assessed a 6% one-year probability of default. Assuming a recovery rate of 40%, **calculate** the expected credit loss.

Answer:

EAD = $10 million × (1 + 0.08) = $10.8 million

Expected credit loss = PD × EAD × LGD = 0.06 × $10.8 million × (1 – 0.4)
= 0.06 × $10.8 million × 0.6 = $388,800

Note that this $388,800 is the average value of credit loss, taking into consideration the relatively low probability of default occurring. If default actually does occur, our loss will be 60% × $10.8 million = $6,480,000.

The Risk-Neutral Modeling Approach

Under a **risk-neutral approach**, we make the assumption that investors do not have a preference for the amount of risk that an investment presents (i.e., they are **risk-neutral investors**), and thus will demand the same amount of return regardless of the level of risk. This assumption of risk-neutrality is of course unrealistic. In real-life, actual investors prefer low risk investments to high risk investments.

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Two key characteristics of the risk-neutral modeling approach make the method indispensable to investors:

1. Modeling under the risk-neutral approach is simple and manageable. The streamlined nature of this approach stems from the fact that we disregard risk aversion. This frees us from the complications of having to distinguish between systematic and unsystematic risk, and from having to calculate the appropriate risk premium for bearing systematic risk.

2. Under certain circumstances, it can be demonstrated that the prices calculated by risk-neutral modeling must be equal to the prices that would exist when market participants are risk-averse. This lends credibility to the use of the simplified risk-neutral modeling approach to price real-world assets.

Risk-neutral probabilities assume that investors are indifferent to varying levels of risk given a level of return. Risk-neutral probabilities are therefore not necessarily real world probabilities. Using risk-neutral probabilities allows risky assets to be discounted using a risk-free rate of return. Pricing models can be created that generate arbitrage-free pricing even when investors are risk averse. However, when investors are risk averse, risk-neutral probabilities cannot be viewed as actual probabilities.

The Risk-Neutral Approach to Bond Pricing

The risk-neutral approach to pricing risky securities uses risk-neutral probabilities and the risk-free rate to determine the value of an asset. Consider a 1-period, zero-coupon risky bond with face value of K and a 1-period risk-free rate of r. The present value of the risky bond can be modeled as the weighted average of a binomial process where the end-of-period values represent the default and non-default states. If the bond defaults, assume the recovery rate is RR. The risk-neutral probability that the bond will default and be worth K × RR is λ, and the risk-neutral probability that the bond will not default and be worth K is $(1 - \lambda)$. Therefore, the present value of the bond can be calculated as:

$$B(0,1) = \lambda \times \frac{K \times RR}{(1+r)} + (1-\lambda) \times \frac{K}{(1+r)} = \frac{K}{(1+r)}\left(\lambda \times RR + (1-\lambda)\right)$$

Provided on Exam

The probabilities in the risk-neutral reduced-form model would only be actual probabilities of default if investors were risk-neutral. In real-world applications using actual probabilities, a risk-adjusted discount rate would need to be used. This risk-adjusted discount rate would include a premium over the risk-free discount rate. An alternative approach would be to use the risk-free rate and reduce the expected payoffs or adjust the probabilities such that the expected payoffs would be reduced. Using adjusted probabilities is equivalent to using risk-neutral probabilities. Risk-neutral models use a value of probability of default λ greater than the true default probability.

From the second version of the formula, it is apparent that the value of a risky bond is equal to the value of a risk-free bond multiplied by a term that adjusts for the credit risk of the bond. Furthermore, we can see that the value of risky debt will increase as the probability of default (λ) decreases, and as the expected recovery rate, RR, increases.

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Calculating a Credit Spread Using the Risk-Neutral Approach

The value of a risky bond can also be calculated by discounting the face value of the bond by the risk-free rate *r* plus a credit spread *s*. The credit spread represents additional compensation for investing in risky debt rather than in risk-free debt. The value today of a risky one-year bond can be expressed as:

$$B(0,1) = \frac{K}{1+r+s}$$

Since both the risk-neutral model and the discount valuation model shown here should produce the same value for the risky bond, the two equations can be equated and the probability of default expressed as a function of the bond's characteristics. Skipping the algebra, the result is:

$$\lambda = \frac{1}{1-RR}\left(\frac{s}{1+r+s}\right)$$

If the short-term risk-free rate and credit spread are not large, this expression above can be approximated by:

$$\lambda \approx \frac{s}{1-RR}$$

This equation states that the risk-neutral probability of default is equal to the credit spread (*s*) divided by the percentage loss on default (1 – RR). Given any two inputs in this relationship, the third can be calculated.

Note that if the expected recovery rate is zero, RR falls away and the risk-neutral probability of default and the credit spread should be approximately equal.

Professor's Note: The LO does not explicitly specify whether the exact or approximate reduced-form model should be used, so be prepared for calculations using either method to appear on the exam.

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Example: Using the reduced-form model to calculate the risk-neutral probability of default

Imagine that the one-year risk-free rate is 5% and a one-year, zero-coupon bond is yielding 7%. The historical recovery rate for bonds of this credit rating is 60%. **Calculate** the risk-neutral probability of default.

Answer:

Using the exact calculation:

$$\lambda = \frac{1}{1-RR}\left(\frac{s}{1+r+s}\right) = \frac{1}{1-0.60}\left(\frac{0.02}{1+0.05+0.02}\right) = 4.67\%$$

Using the approximation:

$$\lambda \approx \frac{s}{1-RR} = \frac{0.02}{1-0.60} = 5\%$$

Example: Using the reduced-form model to calculate the approximate credit spread

Imagine a credit-risky one-year, zero-coupon bond. The one-year risk-free rate is 6%. The historical recovery rate for credit-risky bonds with the same credit rating is 70%. The estimated risk-neutral probability of default is 10%. **Calculate** the approximate credit spread for the risky bond.

Answer:

Using the approximation:

$$s \approx \lambda \times (1-RR) = 10\% \times (1-70\%) = 3\%$$

3% is the approximate spread at which the bond should trade relative to the yield of a riskless bond to offset expected credit losses.

The previous methodology illustrated the process for a single-period zero-coupon risky bond. However, it is straightforward to use the 1-period data to calculate the 2-period default rate, and so on. Continuing this process will generate the term structure of default probabilities for zero-coupon bonds. The same term structure can be used to price risky coupon-paying bonds.

As discussed, the probability of default (λ) calculated from the risk-neutral model should not be viewed as an actual probability of default. The actual probability of default for a bond should be lower than the risk-neutral probability, to compensate a risk-averse investor for bearing risk.

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Calibrating the Reduced-Form Model

One important application of the reduced-form model is to use information gathered from liquid markets to price assets in less-liquid markets. **Calibrating a model** refers to the process of determining the values of the key parameters of the model, such as the risk-neutral probability of default.

Consider a firm with a capital structure that includes both senior and junior debt issues, where the senior issue trades in liquid markets and the junior issue trades in an illiquid market. This is a prime application for the reduced-form model. The firm faces the same level of default regardless of whether we consider the senior or junior debt issues. The difference between the two issues is the recovery rate: the senior issue would have a higher recovery rate. The reduced-form model can be calibrated by calculating the risk-neutral probability of default implied by the senior issue. Then, using this same risk-neutral probability of default, the value of the junior debt issue can be determined.

Example: Application of the reduced-form model

Imagine that a firm currently has one debt issue that is traded in liquid markets, and that the firm is planning to issue a new subordinated issue. The expected recovery rate on the current issue is 70% and the recovery rate on the anticipated subordinated issue is 50%. The current issue is trading at a credit spread of 2%. Using the approximation method, **calculate** the risk-neutral probability of default and the spread for the anticipated bond issue.

Answer:

Using the approximation, the risk-neutral probability of default is:

$$\lambda \approx \frac{s}{1-RR} = \frac{0.02}{1-0.70} = 6.67\%$$

Again using the approximation, the credit spread for the subordinated issue should be:

$$s \approx \lambda \times (1-RR) = 6.67\% \times (1-50\%) = 3.33\%$$

Application of the reduced-form model is not limited to securities from the same issuer as a model can be calibrated using a bond from an issuer that is different from the issuer of the bond to be priced. Furthermore, application of the reduced-form model can be made more sophisticated by incorporating and modeling additional risk factors such as changes in term structure.

Advantages and Disadvantages of the Reduced-Form Model

The straightforward nature of the reduced-form model provides both advantages and disadvantages in estimating default probabilities.

Advantages of the reduced-form model:

1. Highly-liquid instruments, such as a credit default swap (CDS), are available that can be used to calibrate reduced-form models.

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2. Reduced-form models are flexible. They can be used to price not only bonds but also portfolio products and derivatives. Credit rating changes can be incorporated into reduced-form models. Reduced-form models can be used even when we do not have access to the relevant balance sheet (for example, for securities issued by a sovereign issuer.)

Disadvantages of the reduced-form model:

1. The market data available to properly calibrate a model may be sparse or unreliable.

2. The reduced-form model is sensitive to assumptions—and in particular to the assumed recovery rate.

3. It can be a challenge to select appropriate historical default rates to use, because the number of times in history that major companies and sovereign states have defaulted is finite.

4. Historical default rates that we are able to collect may not be accurate representations of future default rates (also known as **hazard rates**), due to changes that have occurred over time.

Comparison of Structural Credit Risk Models and Reduced-Form Models

Reduced-form credit risk models attempt to relate the characteristics of a security being analyzed (such as bond ratings, anticipated recovery rates, and anticipated default rates) to yields and yield spreads. By using such models to analyze securities trading in highly-liquid markets, reduced-form credit risk models can be used to calculate yields, yield spreads, and prices for other securities that are not frequently traded.

In comparison, structural credit models use option pricing models to value securities. Common inputs include the face value of debt, the value of assets and equity, and volatility estimates.

Credit Derivative Markets

LO 26.3: Demonstrate knowledge of credit derivatives markets.

For example:
- **List and discuss the three economic roles of credit derivatives.**
- **Recognize the three major methods for grouping credit derivatives.**
- **Describe the four stages of the evolution of credit derivative activity.**

Derivatives are contracts between two parties that change in value as an underlying asset (such as a bond price or an interest rate) change in value. Derivatives provide a cost-efficient method for investors to transfer or alter their risk profile. Derivatives that transfer credit risk between parties are credit derivatives. **Credit derivatives** provide a way to diversify credit risk and provide liquidity during periods of credit stress. The development of the credit market, as elaborated below, has changed the market for risk from an illiquid market to a liquid market, benefiting many market participants.

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Economic Roles of Credit Derivatives

Credit derivatives assist financial markets and market participants through various risk management and risk diversification mechanisms. Three major roles that credit derivatives play in an economy are as follows:

1. **Risk Transfer:** Consider a bank that has a large, long-term relationship with a firm. The bank provides lending and other financial services to the firm. Over time, the loans to the firm may become too large to maintain in a diversified loan portfolio. The bank would like to continue to loan money to the firm because (1) meeting the firm's loan needs may increase the probability of keeping the other financial services, and (2) loans from other creditors may create conflicts of interest with the bank's existing loans. Credit derivatives allow the bank to continue making loans to the firm by providing a mechanism to transfer the risk of the loans from the bank's loan portfolio to another party. (The reduction in credit risk achieved through an OTC credit derivative comes at the cost of increased counterparty risk, though future increases in exchange-cleared credit derivatives will reduce counterparty risk in credit derivatives trading.)

2. **Liquidity:** When the financial markets are experiencing credit stress, credit derivatives can act to provide liquidity to the market. Due to the growth in the credit derivatives, credit risk has evolved from being an illiquid and un-tradable risk, to a liquid risk that can be traded like any other.

3. **Price Discovery:** The third economic role of credit derivatives is as a tool for price discovery (also called **price revelation**). Because the markets for credit derivatives are highly liquid, these markets provide a significant amount of information about what informed buyers and sellers believe various securities are worth. By being able to observe such indications of the credit risk of various firms, the economy is able to operate more efficiently.

Major Groupings of Credit Derivatives

The credit derivatives market has grown in complexity and size over the past two decades. As such, there are several ways to partition this market.

Single-name versus Multiname Instruments: A security can be either a single-name or a multiname instrument. **Single-name credit derivatives**, as the name implies, are designed to transfer the risk of a single entity or reference. The most common single-name instrument is the credit default swap (CDS), which serves as the building block for more complex products, such as CDS baskets and CDS indices. **Multiname instruments** will transfer risk if there is a credit event on any of the multiple-named references. For example, in a second-to-default basket, the protection buyer will receive a compensatory payment upon the second default but nothing from the first default.

Funded versus Unfunded Instruments: Most credit derivatives are **unfunded credit derivatives**, meaning that only periodic premium payments are made to the protection seller and the notional is transferred between parties only upon a credit event. In this way, unfunded instruments function similarly to interest rate swaps where the periodic fixed and floating payments are netted out but the notional contract size is not exchanged. Unfunded instruments may be single- or multiname. **Funded credit derivatives** involve the transfer of notional principal. For example, a credit-linked note is a corporate bond with an embedded

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credit derivative, so the original purchaser of the note transfers the notional principal upfront to the protection buyer.

Sovereign versus Non-sovereign Entities: Credit derivatives may reference either **non-sovereign entities** (such as corporations) or **sovereign entities** (i.e., governments). There are several important differences between these two categories:

- Sovereign credit derivatives are more complex because they require modeling both the ability and willingness of the sovereign entity to pay its obligors.
- The sovereign market is considerably smaller than the corporate market with little empirical data to test credit models.
- The credit risk analysis of sovereigns must also factor in macroeconomic risks that are not relevant for corporate entities.

Development of the Credit Derivatives Market

Since the late 1980s, the credit derivatives market has developed into a mature market with a variety of participants. The following four stages characterize the evolution of the credit derivatives market.

Stage 1: Defensive Stage (late 1980s–early 1990s). Banks attempted to develop methods to reduce their credit exposures.

Stage 2: Emergence of Intermediaries (1991–late 1990s). This stage saw the emergence of intermediaries as dealers, who began to create credit risk derivatives that were sold to investors looking for credit risk exposure. To this end, total return swaps and synthetic credit products were utilized.

Stage 3: Development of Regulations (late 1990s–2002). During this period, the credit derivatives market reached maturity. Regulation of the market began and the International Swaps and Derivatives Association (ISDA) created the Master Agreement of 1999. Credit dealers began managing diversified portfolios of credit derivatives.

Stage 4: Liquid Market (2003–present). In this stage, the credit derivatives market became more liquid. This was due in part to the revised ISDA Master Agreement of 2003. Index trading beginning in 2004 and the increased presence of hedge funds as protection sellers and protection buyers further increased the liquidity of the market.

A fifth stage may be on the horizon as both U.S. and European Union legislation push the credit derivatives markets to exchange-traded markets with clearinghouses.

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Credit Default Swaps

LO 26.4: Demonstrate knowledge of credit default swaps.

For example:

- **Compare and contrast credit default swaps and total return swaps.**
- **Discuss the standard ISDA agreement as a template for negotiated credit agreements.**
- **Explain and apply the mechanics of credit default swaps.**
- **Explain the mark-to-market adjustment when valuing credit default swap contracts.**
- **Explain three methods for unwinding credit default swap transactions.**
- **Recognize typical credit default swap market participants and their swap transactions.**
- **Identify and explain five typical motivations for using credit default swaps.**

A **credit default swap** (CDS) is a bilateral OTC contract between a protection buyer (short credit risk) and a protection seller (long credit risk). The standard terms of the CDS contract specify the credit reference, notional amount, CDS spread, and maturity. If the CDS has multiple reference entities, it is referred to as a **basket CDS**.

Credit Default Swaps and Total Return Swaps

The two types of swaps that trade credit risk are CDSs and total return swaps. In a CDS, the **credit protection seller** will make a compensatory payment to the protection buyer if a credit event occurs on the reference entity prior to contract maturity. The **credit protection buyer** will make periodic payments, typically quarterly, until contract expiration or a credit event occurs. If a trigger event (i.e., a credit event) occurs, the credit protection buyer must be "made whole" (i.e., receive the value of the notional principal) under cash or physical settlement.

In a **total return swap (TRS)**, the credit protection buyer (who may own the underlying credit risky asset) passes on the total return of the credit risky asset to the credit protection seller in exchange for a fixed payment. The credit protection buyer transfers all risk associated with the credit risky investment including the credit risk to the credit protection seller. Trigger events do not need to be named in a total return swap, as the fixed payment to the credit protection buyer is paid regardless of whether an event occurs.

TRSs and CDSs are both ways of transferring credit risk exposure. However, in the case of a TRS, the total return of the reference asset (i.e., coupon payments and any change in underlying market value) is passed through to the credit protection seller. In exchange, the credit protection buyer receives a fixed return regardless of whether a credit event has occurred. In the case of a CDS, the credit protection buyer makes a swap premium payment and receives a contingent payment only if a trigger event occurs.

Both types of credit swaps are useful in transferring credit risk and, in the case of banks, can be used to remove exposure to a particular client as previously discussed without that client knowing. Additionally, as OTC contracts, credit swaps are flexible and customizable. For example, the amount to be paid if a trigger event occurs or the types of trigger events are both features of a credit default swap that can be negotiated.

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Professor's Note: CDSs are similar to credit put options in that both require a payment from the protection seeker in exchange for a contingent payment based on a credit event. However, CDSs are usually more flexible in that they are structured to meet the specific needs of the buyer and seller.

Mechanics of a Credit Default Swap

Each CDS is a privately negotiated transaction between the CDS buyer and seller. The International Swaps and Derivatives Association (ISDA), the primary industry organization for derivatives documentation, has constructed a **standard ISDA agreement** for a CDS. The standard ISDA agreement acts as a template for market participants to use to negotiate credit agreements. This agreement includes a number of common provisions, and provides specifications for the following five key elements:

1. **CDS spread.** The premium paid by the buyer to the seller of the CDS is called the CDS spread or **CDS premium**. It is quoted in terms of basis points as a percentage of the notional value underlying the CDS.

2. **Contract size and maturity.** The size and maturity of a CDS are determined solely by the buyer and seller, with no limits imposed by the ISDA. Most CDSs have a contract size of $20–$100 million and a length of three to five years.

3. **Payment trigger events.** Trigger events determine when the CDS seller must make a payment to the CDS buyer. The CDS buyer, who is purchasing the credit protection, would prefer to have the trigger events defined as broadly as possible so that payment is more likely to occur. Conversely, the CDS seller, who is responsible for making a payment if an adverse event occurs, would prefer to have the trigger events narrowly defined. These conflicting goals play a key role in the negotiation of terms for a CDS. The ISDA specifies seven types of trigger events:
   - *Bankruptcy*. If a company goes bankrupt, it is unable to pay its debt.
   - *Failure to pay*. Although a firm may not be in bankruptcy, its financial status may render it unable to make interest or principal payments.
   - *Restructuring*. This is a broad term that refers to any kind of debt restructuring that is disadvantageous to the buyer of credit protection.
   - *Obligation acceleration*. Bond and loan covenants typically require the borrower to make accelerated payments if the borrower's financial condition deteriorates.
   - *Obligation default*. This includes technical default where the borrower fails to meet a condition of a bond covenant, such as failing to maintain adequate leverage or coverage ratios.
   - *Repudiation/moratorium*. In the case of sovereign or emerging market debt, the foreign government may refuse to pay its debt for political reasons.
   - *Government intervention*. This trigger event type was added in 2014 and includes instances where a government influences the payment schedule through its actions.

4. **Method of settlement.** If a credit event occurs, settlement can be made with either a cash payment or by physical delivery of the underlying asset. In a **cash settlement**, the CDS seller pays the buyer an amount equal to the lost value of the underlying risky bond. In a **physical settlement**, the CDS seller buys the reference asset from the CDS buyer at par value, and the asset is transferred to the CDS seller's balance sheet. In practice, physical settlement is more common due to the difficulty of obtaining an accurate market quote for a physical asset.

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5. **Choice of assets to deliver.** In a physical settlement, the CDS buyer has a choice of assets to deliver to the seller within certain limits, which invokes the credit protection seller's desire to provide the cheapest to deliver. Delivery choices include the following:
   - Direct obligations of the reference entity such as bonds or loans.
   - Obligations of a subsidiary of the reference entity if the reference entity's ownership stake in the subsidiary is greater than 50%. This may also be referred to as qualifying affiliate guarantees.
   - Obligations of a third party that the reference entity has guaranteed. These obligations are typically referred to as qualifying guarantees.

The advantages of standardization are significant. Participants can easily enter into, unwind, or take offsetting positions. It is also possible to assign the position to a third party. All of these factors have contributed to the growth in the market.

Example: Credit default swap

In reviewing its credit exposures, a bank has decided that it has too much exposure to a key client, an auto manufacturer. Instead of stopping loans to the client and risking losing other key business from the client, the bank decides to transfer the risk via a credit default swap. The bank chooses one of the auto manufacturer's senior unsecured bonds as a reference and determines that the notional amount should be $5 million. The bank finds a hedge fund that is willing to serve as a counterparty in the swap, and the two parties agree to a five-year swap with a 150 bps credit spread. What is the amount of the quarterly payment to be made by the credit protection buyer? In the event of a default, what payments will occur?

Answer:

The quarterly payment to be made by the credit protection buyer, the bank, is $18,750 (= $5 million × 1.5% / 4).

In the event of a default, the credit protection buyer, the bank, will deliver $5 million in face value of a qualifying bond issued by the auto manufacturer. The credit protection seller, the hedge fund, will pay the credit protection buyer $5 million in cash.

There are four key parameters that define a CDS:

1. **Credit reference**. The **referenced asset** (i.e., referenced bond or obligation) is specified within the contract. At default, several bonds may qualify to be deliverable. Senior unsecured bonds are typically referenced, but other bonds can be referenced.

2. **Notional amount**. The amount of credit risk to be transferred is specified in the contract.

3. **CDS spread.** The annual payment amount in basis points (also called the fixed rate, coupon, or price) is specified in the contract. Payments are made on a quarterly basis and accrue on an actual/360 basis.

4. **CDS maturity.** Typical expiration dates are on the 20th of March, June, September, or December. The most common and most liquid length is five years.

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Valuing CDS Contracts

In general, **mark-to-market** (MTM) **adjustment** allows the balance sheet to reflect the current financial position of the CDS contract. Similar to interest rate swaps, the initial value of the CDS contract is zero because the expected cash flows to both the buyer and seller of protection should be equal. However, after initiation, any change in the perceived creditworthiness of the reference entity will create a gain or loss to the protection buyer (and an offsetting loss or gain to the protection seller). If the credit spread widens, then the protection buyer has profited from buying previously undervalued insurance. However, if the credit spread narrows, the protection seller gains from selling previously overvalued insurance. A CDS contract may be marked-to-market for three different reasons: (1) financial statement reporting, (2) economic gain realization, and (3) collateral management.

The MTM gain (or loss) on a CDS is computed as the cost of entering into an offsetting positions (i.e., the difference between the current credit spread and the original contract credit spread). In the previous example, the bank entered into a 150 bps, five-year credit spread. If after one year the credit spread has narrowed to 120 bps, the bank would realize a MTM loss. The bank already makes a fixed payment of 150 bps to the hedge fund. If the bank entered into an offsetting CDS, it would only receive a fixed payment of 120 bps. The actual value of the MTM loss is the present value of the difference in fixed payments accounting for the probability that the contract might be terminated early due to default by the issuer of the underlying asset.

Unwinding a CDS Transaction

There are three principal ways to unwind an existing CDS position: (1) contract termination, (2) offsetting position, and (3) novation. To illustrate how these methods are employed, we will use the following example. Suppose that an investor purchased five-year CDS protection at 200 bps. One year from now, the swap spread has widened to 300 bps and she would like to monetize her position. That is, the protection buyer would like to lock in the 100 bps difference before spreads change.

- *Contract termination*: The easiest unwinding method would be for the counterparty to agree to terminate the contract. To do so, the protection seller would transfer the present value of 100 bps for four years to the protection buyer. This transaction assumes that the contract will last until maturity without a credit event occurring. This assumption is, of course, unrealistic since a default is still possible. Therefore, to account for the positive probability of default, the present value is calculated with a discount rate that reflects credit risk.
- *Offsetting position*: This method involves entering into an offsetting position with another counterparty. To perfectly hedge the remaining cash flows, the investor sells protection for four years at 300 bps on the same notional principal. Assuming there is no counterparty default, the investor pays 200 bps per period but receives 300 bps per period, netting the 100 bps per year difference. If a default occurs prior to maturity, the investor receives the par value under the terms of the original contract but is liable to the protection buyer for the par value in the offsetting contract, cancelling out any exposure.
- *Novation*: This unwinding method assigns the trade to a third party—a process called **novation** or **assignment.** Under this method, the investor would receive the present value of the contract from the assignee with the original terms of the contract remaining in force. Since there is still counterparty risk with the new assignee, the original counterparty must agree to the novation.

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Participants in Credit Derivatives Markets

The credit derivatives market comprises a diverse set of end-users with differing motives (i.e., hedging vs. speculation). The major participants in the credit derivatives market are banks, hedge funds, asset managers, insurance companies, and corporations. We will briefly discuss each type of entity and their role in the market:

- *Bank trading activities.* In the past, market makers were constrained by position limits in individual companies or sectors. The CDS market allows market makers to more efficiently make trades, hedge positions, and to use less capital.
- *Bank loan portfolio managers.* Banks were the driving force behind the development of the credit derivatives market. Their use of CDSs allowed for efficient hedging of exposure to existing loans as well as reducing regulatory capital.
- *Hedge funds.* Hedge funds have steadily increased their presence in the credit derivatives market, using varied and complex trading strategies. In the past, convertible arbitrage hedge funds used CDSs as efficient credit risk transfer mechanisms. More recently, hedge funds have begun trading across volatility, correlation, and recovery rate strategies rather than just hedging a single-name exposure.
- *Asset managers.* Credit derivative markets allow asset managers, such as pension funds and mutual funds, to trade at maturities that may have limited liquidity in the underlying bond market. In addition, asset managers can easily implement bearish views. Further, the popularity of indices has allowed managers to easily add or shed broad credit exposure.
- *Insurance companies.* Life and property insurance companies are natural sellers of credit protection. Their objective is to increase return on their investment portfolio by selling options (i.e., protection) they do not expect to be exercised. In contrast, monoline insurers and reinsurers sell credit protection to enhance return and diversify their exposure to include credit risk.
- *Corporations.* Corporations typically use credit derivatives to hedge exposure to an existing counterparty. The high liquidity and transparency of the market is a viable alternative to securing credit insurance or costly factoring (i.e., selling receivables). In addition, corporations may attempt to increase returns to pension funds or excess cash balances via credit derivatives. Additionally, corporations may observe their own CDS spreads as benchmarks for bond deals in order to minimize funding costs.

Motivations for Credit Default Swaps

The growth in the CDS market is a result of the following five factors:

1. *Credit derivatives can efficiently isolate pure credit risk.* In contrast, a long bond position involves not only credit risk but also interest rate risk, currency risk, and other risks. CDSs allow for credit risk adjustment without adjusting other risk exposures.

2. *Synthetic short credit positions can be implemented cheaply and effectively.* This is particularly important in less liquid segments of the market and in areas of the credit term structure where significant gaps exist (i.e., where credit securities are unavailable to short).

3. *Credit derivatives can synthetically create credit exposure without owning the underlying asset.* The customization of the OTC contract allows investors to obtain credit exposure to all parts of the capital structure, not just the senior unsecured bonds in a typical CDS. Investors can also obtain exposure to baskets and tranches that are designed specifically for their desired risk-return profile.

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4. *Credit derivatives serve as a link between bond, loan, equity, and structured product markets*. As such, they are likely to react faster than the underlying bond or loan markets to new and relevant information. The reaction of credit derivatives will often lead underlying markets to adjust to the new information to prevent arbitrage.

5. *Credit derivatives can provide much needed liquidity, particularly during market stress*. Unlike bond trading desks, which are long credit risk, credit derivative desks are more likely to be short credit risk and are therefore better able to shift their net position.

Other Credit Derivatives

LO 26.5: Demonstrate knowledge of credit options and credit-linked notes.

For example:
- **Contrast credit default swaps and credit options.**
- **Recognize the terminology of credit options.**
- **Explain the credit put option on a bond.**
- **Explain call options on credit default swaps.**
- **Describe credit-linked notes.**

CDSs, while not considered an option, are similar to options with regard to the asymmetric (contingent) payout. If there is no trigger event, then there is no payment by the credit protection seller. If there is a credit event, then there is a (potentially large) payment made by the credit protection seller.

However, there are several key differences between CDSs and options. The pricing of CDSs is such that there is no initial premium or payment made by one party, whereas the buyer of an option must pay a premium. Additionally, options provide the buyer a right to exercise, given that certain conditions are met. CDSs, on the other hand, automatically require payment given that a trigger event has occurred.

We will discuss the details of how credit put options and credit call options work below, but know that both credit puts and credit calls protect against declines in market values as a result of credit quality deterioration.

Credit Option Terminology

Call options give the buyer the right to "buy" an underlying at a predetermined price, while put options give the buyer the right to "sell" an underlying at a predetermined price. With credit options, the underlying can be an interest rate (or spread) or the price of a bond. Because of the inverse nature of bond prices and rates, a put option on a bond price and a put option on an interest rate are opposing bets.

An investor seeking credit protection can purchase (i.e., enter into a long position) in a bond price put option or a spread call option. In the event of a credit issue, the bond price will decrease and the spread will widen such that either option position will benefit.

Credit options are frequently **binary options**, meaning that there are only two payouts: (1) nothing or (2) a fixed payout if a trigger event occurs. Exercise of a binary option may not be at the discretion of the option buyer as the terms of the contract may specify the

basis of payout given a trigger event. Credit options may be **European credit options**, only exercisable at expiration, or **American credit options**, exercisable at or before expiration.

Bond Credit Put Option

The payout on a credit put option (non-binary) can be expressed as follows:

payout = Max[0, X – B(t)] if in default, and 0 otherwise

where:
X = strike price
B(t) = underlying bond price

If the issuer of the underlying was in default, the put would pay the higher of zero, and the difference between the strike price and the price of the underlying. If the issue was not in default, the payout would be zero. If the option were an American style option, the payout could occur at-or-before expiration, whereas with a European option payout would only occur at expiration.

CDS Call Option

A credit option can be written where the underlying is a CDS. A long position in a CDS call option allows the holder of the option to enter into a CDS contract if the credit spread widens beyond the strike value.

A bondholder will enter into a long CDS call option position to provide downside protection against the risk of default. The bondholder will pay a premium to purchase the call option. If the credit spreads widen beyond the strike, the bondholder has the option to enter into the CDS contract.

The underlying bond combined with the CDS call option differs from the underlying bond combined with the CDS. The bond combined with the call option allows the bondholder to realize the benefits of credit improvements: if credit improves, the bond price rises, and the option expires out of the money. The bond combined with the call option provides downside protection—if credit deteriorates, the bond price falls, and the option can be exercised. In contrast, a position that consists of the underlying bond and CDS provides downside protection but does not benefit from credit improvements.

Credit-Linked Notes

A **credit-linked note** (CLN) is a bond issued with an embedded credit option. CLNs are either issued based on a single-reference asset or a basket of multiple-reference assets. If there is no default, the holder of the CLN receives a coupon payment and the payment of par value at maturity, similar to a standard bond. If there is a default or other negative credit event, the CLN investor will either receive a reduction in the coupon payment or a partial redemption of the CLN's principal value.

The reason why a CLN investor is willing to share in the losses if a negative credit event occurs is because the investor will receive a higher coupon payment as compensation for bearing the credit risk. The issuer of the CLN effectively pays the investor an insurance premium in the form of a higher coupon payment for credit protection. If a negative credit

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event occurs, the CLN investor will give up a portion of the coupon payment or principal value for the seller's benefit.

CLNs are customizable and useful for investors who want to take on more credit exposure but are unwilling or unable to invest in derivatives, such as swaps or options. The CLN functions similarly to a standard bond by making coupon or principal payments and is an on-balance-sheet security.

CDS Indices

LO 26.6: Demonstrate knowledge of credit default swap indices.

For example:
- **Describe credit default swap index products.**

CDS indices are equally-weighted baskets of single-name CDSs. CDS indices are tradable and allow investors access to broad, deep, and liquid credit markets through long or short positions. The two most common indices are the CDX (North America and emerging markets) and iTraxx (Europe and Asia) indices. The CDX and iTraxx indices each consist of 125 single-name CDSs.

The constituents and maturity of a CDS index are fixed. As time passes, the time to maturity decreases. New indices are issued every six months such that investors can roll into the current on-the-run index. Because the credit spread curve is upward sloping, newer indices (which have longer maturities) will have higher market values.

The market for indices is highly liquid, so the relatively lower liquidity premium reduces the index spread relative to the underlying single-name CDSs. As is typical in other derivative markets, the index is likely to reflect new information quickly because the price of the index is driven by investors buying and selling the index to express their positive and negative views of the index, which contributes to the greater liquidity of the index.

Risks of Credit Derivatives

LO 26.7: Demonstrate knowledge of the five key risks of credit derivatives.

For example:
- **Discuss the risks of excessive credit exposure using off-balance-sheet derivatives, pricing risk of over-the-counter derivatives, and liquidity risk of over-the-counter derivatives.**
- **Discuss the counterparty risk of over-the-counter credit default swaps and the basis risk of credit default swaps.**

Credit derivatives offer investors a variety of advantages related to taking on or reducing credit exposure. However, using credit derivatives is not without risk. Risks associated with credit derivatives include:

1. **Risk taking.** Traders or investors may use credit derivatives improperly. Most credit derivatives are off-balance-sheet instruments, so without adequate supervision and accounting systems, it can be easy to take on excessive leverage or credit risk exposure without that exposure being reflected in the firm's financial statements.

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2. **Pricing risk.** Credit derivatives are often priced using complex mathematical models. The accuracy of these models depends on the inputs used and how they are applied. If the wrong assumptions are made, or if the model is used inappropriately, the model's estimate of a credit derivative's price may be inaccurate.

3. **Liquidity risk.** Since credit derivatives are customized for the needs of a specific buyer and seller, it is unlikely that a particular contract will fit the needs of other parties in the financial markets. As a result, a derivative counterparty may have to offer a significant liquidity discount in order to transfer its position to a third party. In addition, approval by the original counterparty is typically required before a credit derivative can be sold.

4. **Counterparty risk** is the risk that a counterparty to a transaction fails to make a payment as required by the underlying contract. In OTC options (e.g., call options or put options), only the long party faces counterparty risk. The short party faces no counterparty risk, because the long party has no additional financial obligation after paying the initial option premium.

   When we consider a CDS on the other hand, counterparty risk is present for both the protection seller and the protection buyer, because both may be required to make payments. The protection seller is exposed to the risk that the protection buyer will default on the fixed payment. The protection buyer faces the risk that the protection seller may fail to make the required payment when the underlying defaults. The protection buyer is exposed to greater counterparty risk however.

   The protection buyer's counterparty risk can develop in two ways:

   - The reference entity suffers a credit event resulting in default, and the protection seller also defaults. The probability of a double default can be high if the reference entity and protection seller have similar macroeconomic exposures.
   - Even without default from the underlying, the protection buyer faces counterparty risk. If the creditworthiness of the credit protection seller declines, the market value of the CDS will decline, resulting in a loss for the credit protection buyer.

5. **Basis risk** is the risk that the value of the CDS and the value of the asset that the CDS is intended to hedge are not perfectly correlated. This occurs when the protection buyer enters into a CDS with a reference entity or asset that does not exactly match the asset being held. A protection buyer may enter into a CDS with a different reference entity because the CDS has higher liquidity than a CDS that more closely matches the asset to be hedged.

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Key Concepts

LO 26.1

Credit risk is the risk that a borrower will not fully repay principal and interest. The return distribution for lenders is left skewed because potential losses can be large (i.e. the entire principal amount) while gains are capped at the amount of promised interest. Default risk is the risk that the issuer of a bond will not meet required interest or principal payments.

LO 26.2

The two major categories of credit models are structural models and reduced-form models.

- Structural credit models value debt securities by incorporating factors including the corporate structure (e.g., debt-to-asset ratio) and the volatility of the firm's assets.
- Reduced-form credit models use market prices for liquid securities to infer the implied default probability. Once calibrated, reduced-form models can be used to price illiquid securities.

Expected credit loss is a function of the probability of default (PD), the exposure at default (EAD), and the loss given default (LGD), where the loss given default is equivalent to one minus the recovery rate (RR).

expected credit loss = PD × EAD × LGD

or equivalently:

expected credit loss = PD × EAD × (1 – RR)

The reduced-form model uses the result that the risk-neutral probability of default (λ) is $\lambda = \frac{1}{1-RR}\left(\frac{s}{1+r+s}\right)$.

Assuming that *r* and *s* are small, this expression is approximately equal to $\lambda \approx \frac{s}{1-RR}$.

The reduced-form model is a risk-neutral model. Compared to the risk-neutral probability, the actual probability of default will be lower and the expected return higher, to compensate for risk. A risk-neutral probability determined from a liquid bond issue can be used to price illiquid bonds in spite of differing levels of risk.

Reduced-form models have advantages and disadvantages:

- Advantages include the ability to extract information from market prices and flexibility.
- Disadvantages include the potential lack of adequate market data needed to calibrate the model, sensitivity to key assumptions, limited historical default rates, and no guarantee that historical default rates represent future default rates.

Reduced-form credit risk models attempt to relate the characteristics of a security being analyzed (such as bond ratings, anticipated recovery rates, and anticipated default rates) to yields and yield spreads. In comparison, structural credit models use option pricing models to value securities. Common inputs include the face value of debt, the value of assets and equity, and volatility estimates.

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LO 26.3

Credit derivatives have the following three major economic roles:

1. Allow a bank to continue making loans to a major client by providing a mechanism to transfer some of the risk of the loans to another party.

2. Act to provide liquidity to the market in times of financial market stress. Credit derivatives have changed credit risk from an illiquid risk to a liquid risk that can be traded like any other.

3. Assist in price discovery. The highly-liquid markets for credit derivatives provide information about what informed buyers and sellers think various securities are worth.

Credit derivatives can be grouped into three major categories:

1. Single-name versus multiname. Single-name instruments reference just one entity, while multiname instruments reference a number of securities.

2. Funded versus unfunded. Funded credit instruments involve the transfer of notional principal, while unfunded instruments do not.

3. Non-sovereign versus sovereign. Sovereign instruments such as government bonds are more complex to model than non-sovereign instruments such as corporate bonds, because sovereign instruments are exposed to additional risks such as willingness to pay.

There have been four major stages of credit derivatives:

- Stage 1: Defensive Stage (late 1980s–early 1990s).
- Stage 2: Emergence of Intermediaries (1991–late 1990s).
- Stage 3: Development of Regulations (late 1990s–2002).
- Stage 4: Liquid Market (2003–present).

LO 26.4

A credit default swap (CDS) makes a payment only if a credit event occurs. In a total return swap (TRS), the swap buyer receives the total return of the reference asset regardless of whether a credit event occurs.

The buyer of a TRS (i.e., the credit protection seller) receives the total return of a reference asset in exchange for LIBOR + spread, and assumes all credit risk exposure associated with the asset. The seller of the TRS (i.e., the credit protection buyer) retains ownership, but since cash flows are passed to the buyer, the seller receives a net cash flow of LIBOR + spread.

Terms negotiated between the CDS buyer and seller include:

1. CDS spread.

2. Contract size and maturity.

3. Payment trigger events.
   - Bankruptcy.
   - Failure to pay.

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- Restructuring.
- Obligation acceleration.
- Obligation default (technical default).
- Repudiation/moratorium by a sovereign government.
- Government intervention.

4. Method of settlement.

5. Choice of assets to deliver.

CDSs are priced to have zero value at initiation because the values of expected cash flows to both parties are equal. Marking-to-market (MTM) allows the balance sheet to reflect the current financial position of a CDS contract.

A CDS contract may be unwound by:

1. Offsetting: Taking an opposite position either in another CDS contract or in the underlying asset.

2. Assignment/Novation: Finding a dealer or other third party that will take over the obligations of the contract.

3. Terminating: The original counterparties agree to discontinue the contract.

There are six major types of participants in the credit derivatives market:

1. Bank trading activities.

2. Bank loan portfolio managers.

3. Hedge funds.

4. Asset managers.

5. Insurance companies.

6. Corporations.

Motivations for entering into CDSs include:

1. Isolation of credit risk.

2. Efficient shorting of credit risk.

3. Ease of establishing synthetic positions.

4. Linking of markets.

5. Liquidity during periods of market stress.

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LO 26.5

While CDS are not options, CDS are similar to credit options with regard to their asymmetric (contingent) payout.

Key differences between credit default swaps and credit options are:

- There is no initial premium or payment made by either party to enter into a CDS.
- CDSs automatically require payment when a trigger event has occurred (i.e., there is no option to exercise).

Credit options can have an "underlying" of a price, a rate, or a spread. Since rates (and spreads) move opposite to security prices, a credit put on a bond prices and credit calls on a rate offer the same protection against declines in market values because of credit quality deterioration. Credit options can be binary, where there are two payouts: (1) zero or (2) a fixed amount. Additionally, credit options can be European (which pay out at expiration only), or American, (which can pay out before expiration).

The payout on a credit put option can be expressed as follows:

$$\text{payout} = \text{Max}[0, X - B(t)] \text{ if in default, and 0 otherwise}$$

A long position in a CDS call option allows the holder of the option to enter into a CDS contract if the credit spread widens beyond the strike price. A CDS call option offers a bondholder downside protection against the risk of default, while allowing the bondholder the ability to realize the benefits of credit improvements. In contrast, a position that consists of the underlying bond and CDS provides downside protection but does not benefit from credit improvements.

Credit-linked notes (CLNs) offer investors higher coupon interest in exchange for bearing a portion of the credit risk associated with the note.

LO 26.6

CDS indices are equal-weighted baskets of single-name CDSs that are tradable. The constituents and maturity of a CDS index are fixed, but new indices are issued every six months. The two most common indices are CDX (North America and emerging markets) and iTraxx (Europe and Asia) indices. Both consist of 125 single-name CDSs.

LO 26.7

Major risks associated with credit derivatives are:

- Operational risk.
- Liquidity risk.
- Pricing/model risk.
- Counterparty risk.
- Basis risk.

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Concept Checkers

1. The distribution of credit returns:
   A. is approximately normal.
   B. is right skewed as gains are capped at promised interest.
   C. exhibits infrequent but relatively large losses.
   D. exhibits frequent losses, but most are economically small.

2. Which of the following is **NOT** an explicit factor in the calculation of expected credit loss?
   A. Recovery rate.
   B. Probability of default.
   C. Loan maturity.
   D. Exposure at default.

3. Which of the following statements about reduced-form models is *least accurate*? Reduced-form models:
   A. use information from liquid securities to infer an implied probability of default.
   B. use information from liquid securities to price less liquid securities.
   C. discount risky bonds at a rate of one plus the credit spread.
   D. assume a binomial pricing function.

4. The capital markets have assigned ABC Corp's one-year zero-coupon debt a credit spread of 150 basis points. Assuming an 8% probability of default in the next year, which of the following is *closest* to the implied recovery rate from the reduced-form model?
   A. 12%.
   B. 20%.
   C. 81%.
   D. 88%.

5. Which of the following statements regarding credit derivatives is *most accurate*?
   A. Funded instruments make up the largest segment of the credit derivatives market.
   B. Funded instruments face higher counterparty risk.
   C. Multiname instruments include credit indices but not first-to-default baskets.
   D. Credit default swaps are unfunded instruments.

6. Which of the following statements *most accurately* describes the difference between a total return swap and a credit default swap?
   A. One is privately negotiated and the other is traded on an exchange.
   B. One provides a reduction in capital and the other does not.
   C. One provides an enhanced return to the investor and the other does not.
   D. One provides cash flows contingent on a default event and the other does not.

7. ISDA Master Agreements specify all of the following contract terms **EXCEPT**:
   A. benchmark interest rate.
   B. triggering events.
   C. cash or physical settlement.
   D. set of deliverable obligations.

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8. Which of the following is **NOT** a standard term of a CDS contract?
   A. Upfront exchange of principal.
   B. Reference entity.
   C. Spread.
   D. Maturity date.

9. Which of the following statements about marking contracts to market is *most accurate*?
   A. Protection sellers benefit if the current swap spread is greater than the original contract swap spread.
   B. Protection sellers benefit if the current swap spread is less than the original contract swap spread.
   C. Protection buyers benefit if the current swap spread is less than the original contract swap spread.
   D. Protection buyers lose if the spread has widened over time.

10. Which of the following is **NOT** a use for credit default swaps?
   A. Conduit of information between markets.
   B. Ability to create synthetic exposure.
   C. Transfer of counterparty risk.
   D. Liquidity during periods of market stress.

11. Which of the following statements regarding a credit put on a bond price and a credit call option on a rate is *most accurate*?
   A. The credit call option makes a payoff if there is an improvement in credit conditions, while the credit put option makes a payoff if there is deterioration in credit conditions.
   B. The credit call option makes a payoff if there is deterioration in credit conditions, while the credit put option make a payoff if there is an improvement in credit conditions.
   C. Both the credit call option and the credit put option make payoffs if there is deterioration in credit conditions.
   D. Both the credit call option and the credit put option make payoffs if there is improvement in credit conditions.

12. The buyer of a credit-linked note (CLN):
   A. is purchasing an off-balance-sheet asset.
   B. is protected if the issuer of the note has a decline in credit quality.
   C. receives a higher coupon from the CLN versus a standard bond.
   D. only receives a payment if a credit event occurs.

13. With regard to a CDS, which of the following is *most accurate* regarding counterparty risk?
   A. Only protection sellers bear counterparty risk.
   B. Only protection buyers bear counterparty risk.
   C. Both protection sellers and protection buyers bear counterparty risk.
   D. Protection sellers bear more counterparty risk than protection buyers.

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14. Which of the following is **NOT** a typical feature of CDS indices?
    A. The indices are equal-weighted.
    B. The indices trade with a fixed deal spread.
    C. The indices trade at a spread equal to the average of the single-name constituent spreads.
    D. Each index has a unique maturity in addition to unique components.

Concept Checker Answers

1. **C** Defaults are relatively rare events but typically result in significant losses. Thus, the credit return distribution is left-skewed. (LO 26.1)

2. **C** Expected credit loss = PD × EAD × (1 – recovery rate). Loan maturity does not explicitly enter into the calculation. (LO 26.2)

3. **C** Risky bonds are discounted at 1 + r + s, not 1 + s. (LO 26.2)

4. **C** The reduced-form model assumes $\lambda \approx \frac{s}{1-RR} \Rightarrow 0.08 = \frac{0.015}{1-RR} \Rightarrow RR = 81.25\%$. (LO 26.2)

5. **D** Credit default swaps require initial payment to establish position. (LO 26.3)

6. **D** A credit default swap is similar to an insurance contract in that a CDS only makes a payment if a credit event occurs. Therefore, CDS payment is only made if an adverse credit event occurs. In the case of a total return swap, the swap buyer receives the total return of the reference asset regardless of whether a credit event occurs. Note that both instruments are means for transferring credit risk exposure, and neither instrument trades on an exchange. (LO 26.4)

7. **A** Interest rates are not part of the key ISDA Master Agreement terms. Interest rates are negotiated by the counterparties to the agreement. (LO 26.4)

8. **A** CDS contracts are typically unfunded. Notional principal is exchanged only after a credit event. (LO 26.4)

9. **B** Protection sellers benefit when the swap spread narrows over time. Narrowing credit spreads suggest that the protection seller sold overpriced insurance in a previous period. (LO 26.4)

10. **C** CDSs allow for transfer of credit risk, not counterparty risk. Counterparty risk is a major risk of a CDS. (LO 26.7)

11. **C** Credit put options on bond values and credit call options on rates are similar in that they both provide protection against declines in market values resulting from credit quality deterioration. (LO 26.5)

12. **C** CLNs contain an embedded credit option. If there is no default, the holder of the CLN receives a coupon payment, plus par value at maturity—similar to a standard bond. If there is a default or other negative credit event, the CLN investor will either receive a reduction in coupon payment or a partial redemption of the CLN principal value. CLN investors are willing to share in the losses of a negative credit event is because the CLN investor receives a higher coupon payment as compensation for bearing credit risk. (LO 26.5)

13. **C** Protection buyers bear the significant counterparty risk of non-payment on credit events. Protection sellers bear a small amount of counterparty risk reflecting the possibility that the protection buyer may not make the required premium payments. Protection buyers bear more counterparty risk than do protection sellers. (LO 26.7)

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14. **C** CDS indices generally trade away from the average of the single-name constituent spreads since credit events in the index and among the single-name constituents differ. A CDS index is highly liquid and hence offers a narrower spread, all else equal. (LO 26.6)

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The following is a review of the Structured Products principles designed to address the learning objectives set forth by the CAIA Association®.

CDO Structuring of Credit Risk

Topic 6.3

Exam Focus

This topic review provides an overview of collateralized debt obligations (CDOs). The two main types of CDOs in the market today are balance sheet CDOs and arbitrage CDOs. Balance sheet CDOs are primarily used by banks to transfer credit risk off of their balance sheets, while arbitrage CDOs are used by money managers trying to earn an arbitrage profit. This topic review also introduces several developments in the CDO market, including distressed debt CDOs, hedge fund CDOs, and single-tranche CDOs. Focus your attention on understanding the general structure and risks of CDOs. CDOs provide investors with a way to slice and dice risk exposures to meet specific needs. Financial innovation has allowed CDOs to be created with virtually any type of assets serving as collateral.

Introduction to Collateralized Debt Obligations

LO 27.1: Demonstrate knowledge of collateralized debt obligations (CDOs).

For example:
- **Describe the history of CDOs.**
- **Describe the general structure and life cycle of a CDO.**
- **Explain the terminology and details of CDOs.**

Historical Overview of CDOs

The first CDOs started in the late 1980s with the repackaging of high-yield bonds. The senior tranche, which is a large portion of the CDO, can be rated as investment grade by a rating agency through the diversification of the portfolio of bonds, tranching, and other credit enhancements. The original CDOs that repackaged bonds were known as collateralized bond obligations (CBOs). In the 1990s, the CDO structure was used to repackage loans in what were called collateralized loan obligations (CLOs).

The repackaging of mortgages using the CDO structure is known as collateralized mortgage obligations (CMOs). CDO is a more general term that refers to the repackaging of debt including bonds, loans, and mortgages.

CDO Structures

There are three periods of a CDO:

1. **Ramp-up period.** In this period, the portfolio manager puts together the initial collateral portfolio financed by the sale of CDO tranches to investors. The document that governs the CDO trust dictates which type of assets the portfolio manager can purchase.

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2. **Revolving period.** This period is also called the *reinvestment period* because the portfolio manager is actively managing the collateral portfolio and reinvesting interest, prepayments, and loan default recovery payments.

3. **Amortization period.** This period is sometimes called the *pay down period* because the portfolio manager is no longer reinvesting cash flows but is instead using cash and collateral security maturities to make principal payments to CDO tranche holders.

A sponsor, known as the **sponsor of the trust**, forms the CDO. This sponsor is usually a bank and must bear the burden of the administrative and legal costs of the trust. The trust is typically setup as a Delaware or Massachusetts business trust with the trust being a special purpose vehicle. A **special purpose vehicle** (SPV) is a separate legal entity used to hold the assets in a CDO structure. The SPV owns the collateral (debt securities) placed in the trust and issues notes and equity that correspond to the various tranches in the CDO structure.

The key advantage of an SPV structure is that it is a completely separate legal entity from the sponsor of the CDO. This makes the SPV **bankruptcy remote**, meaning that the assets held by the SPV are secure from any financial difficulties suffered by the bank or brokerage firm sponsoring the CDO.

It is at the SPV level that the various tranches of credit exposure are created in the CDO structure. While every tranche may have its own credit rating, most will have investment grade ratings. The lowest subordinated debt tranche and the equity tranche are general exceptions to this. The equity tranche is also called the *first loss tranche* because it is the last to receive any cash flows from the CDO collateral, and it is the first tranche to absorb any defaults or losses. The CDO sponsor will often retain the equity tranche.

CDO Terminology

The portfolio of assets that the CDO trust holds is commonly called the **reference portfolio** or the collateral. Three measures are used to describe this underlying pool:

1. The **weighted average rating factor** (WARF) measures the risk of the underlying collateral and is the average rating factor of the collateral contained in the CDO trust. The rating factor is a scale developed by Moody's that rates securities from 1 to 10,000, with 1 representing Aaa securities and 10,000 representing the lowest rated. The scale is non-linear meaning that the rating factor increases at an increasing rate as the credit score decreases. A higher WARF is indicative of higher risk, so lower rated issues (e.g., BBB) will have a higher WARF than higher rated issues (e.g., AAA). Every CDO trust indenture contains covenants that set the required average credit rating for the collateral pool.

2. The **weighted average spread** (WAS) over LIBOR is a measure of the underlying portfolio's return and is computed as the average of the spreads of the underlying securities. The spread of an underlying security is the yield in excess of LIBOR with identical maturity. Most CDO trust indentures also contain a minimum level for the WAS over LIBOR.

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3. The **diversity score** measures the diversification of the underlying portfolios. Specifically, the diversity score represents the number of uncorrelated assets within the portfolio. A pool with 50 perfectly correlated assets would receive a diversity score of 1. A pool with 26 perfectly correlated assets and 24 completely uncorrelated assets would receive a diversity score of 25.

The challenge for the CDO manager is that the WARF and the WAS are often at odds. In most market environments, the only way the manager can increase WAS is to take on more credit risk, which will increase the WARF. The opposite is also true in that increasing the average collateral credit rating (i.e., decreasing the WARF) comes at the expense of a decrease in the WAS.

Tranche width represents the size of a particular tranche as a percentage of the total CDO. Tranche width can also be calculated as the difference in the detachment and attachment points. Adjusting tranche width allows a CDO to be structured to obtain desired ratings for individual tranches.

Balance Sheet CDOs vs. Arbitrage CDOs

LO 27.2: Demonstrate knowledge of balance sheet CDOs and arbitrage CDOs.

For example:
- **Discuss the purposes and attributes of balance sheet CDOs.**
- **Discuss the purposes and attributes of arbitrage CDOs.**
- **Describe and apply a typical arbitrage CDO structure.**
- **Analyze the cash flows in a typical arbitrage CDO structure.**

The differences between balance sheet and arbitrage CDOs stem from differences in the motivations to create the CDOs. **Balance sheet CDOs** are used primarily by banks and insurance companies as a means to manage assets on their balance sheet. **Arbitrage CDOs** are used primarily by money managers, with the motivation to generate an arbitrage profit created by the spread between the return received on the collateral pool and the return paid to investors in the CDO tranche securities.

Characteristics of Balance Sheet CDOs

The sponsor of a balance sheet CDO is typically a bank or insurance company (or other financial institution) that wants to remove assets from its balance sheet. The bank creates the CDO by forming an SPV and selling assets to the SPV. The bank will often then serve as the CDO's asset manager under a separate arrangement with the trust. The CDO trust will employ a trustee (not the bank due to conflicts of interest) to protect the CDO tranche investors.

When an entity chooses to issue a balance sheet CDO, they typically have one of three goals:

1. *Reduce credit exposure to a certain client or industry.* By transferring an asset to a CDO, the asset and the corresponding credit exposure are removed from the firm's balance sheet.

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2. *Capital infusion.* By selling risky credit assets to a CDO, the bank or insurance company can receive an infusion of cash that can be used to pay down debt or purchase additional assets.

3. *Reduce regulatory capital charges.* Under the Basel Accord (a set of recommendations on international banking laws and regulations), banks are required to maintain risk-based regulatory capital to support risky assets. By removing risky credit assets from the balance sheet, the bank is free to use this regulatory capital for other purposes.

Balance sheet CDOs are primarily self-liquidating, where all interest and principal payments are distributed to the CDO tranche investors instead of being reinvested. Some balance sheet CDOs, however, will allow for the reinvestment of interest and principal payments. After the reinvestment period, the CDO would move into an amortization period, where the CDO liquidates by paying out all interest and principal payments.

Characteristics of Arbitrage CDOs

The structure of an arbitrage CDO is virtually identical to the structure of a balance sheet CDO. The key difference is that the sponsor of the CDO trust is usually an investment management firm who purchases the securities collateralizing the CDO in the open market in order to make a profit, rather than a bank who sells securities to the CDO for risk management purposes.

The primary objective of an arbitrage CDO is to earn profits through management fees and through the excess spread in the equity tranche that is retained. Most arbitrage CDOs are sponsored by investment management firms who sell the CDO tranches at a yield lower than the yield earned on the collateral backing the CDO (i.e., the arbitrage profit), thereby creating a spread for the equity tranche. An alternate view is that the CDO tranches are issued at a higher aggregated price than what is paid for the underlying securities, resulting in a higher residual value for the equity tranche. Arbitrage CDOs provide a method for investment management firms to increase assets under management and income.

Hypothetical Arbitrage CDO

Consider a hypothetical five-year arbitrage CDO with a money manager who raises $300 million by selling three tranches: senior, mezzanine, and equity. The money manager uses the proceeds to purchase $300 million par value of high-yield bonds with a current market value of $270 million. With the remaining proceeds, the money manager purchases $30 million of five-year U.S. Treasuries that have a 5% coupon.

Figure 1 illustrates the hypothetical CDO. The money manager will earn a profit from her position in the equity tranche as well as from the annual management fee. If we assume that the money manager charges the CDO an annual management fee of 30 basis points, the annual fee will be $0.9 million (= $300 million × 0.30%). The CDO must also pay fees including the fee to the trustee.

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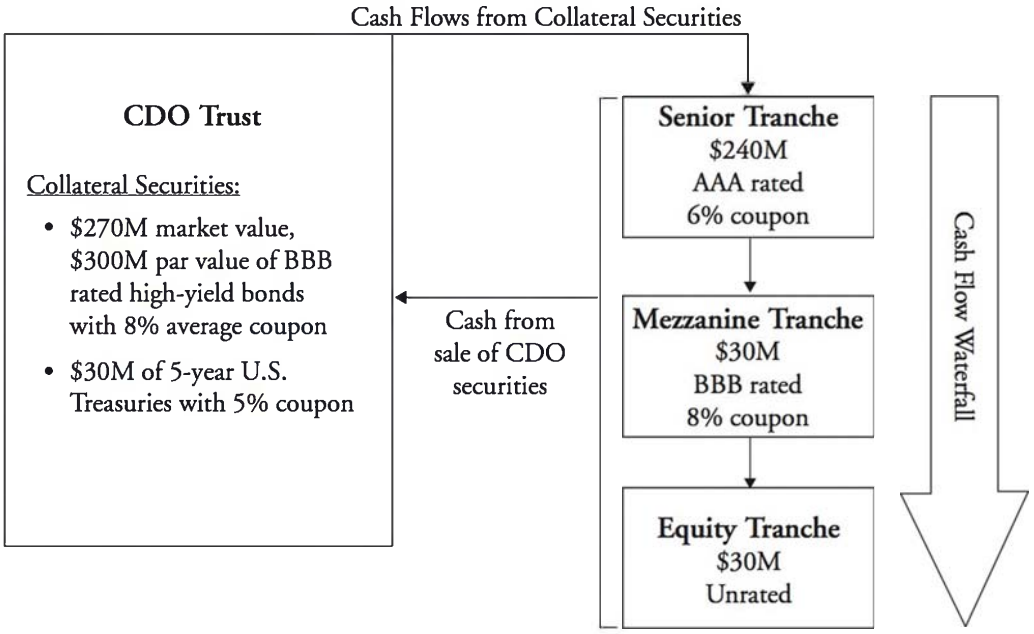
Figure 1: Hypothetical Arbitrage CDO



Cash Flow Allocation for the Hypothetical CDO

The annual income from the collateral securities is $25.5 million (= $300 million × 8% + $30 million × 5%). The income must first pay the annual management fees of $0.9 million and the annual expenses, which we will assume to be $1.3 million.

After management fees and expenses, assuming there are no defaults, there is $23.3 million to distribute to the CDO investors. The senior tranche will receive $14.4 million (= $240 million × 6%) and the mezzanine tranche will receive $2.4 million (= $30 million × 8%). The remaining $6.5 million accrues to the equity tranche, representing a 21.7% return to the equity investors.

Given no default, the return to the equity investors is high, but this return comes with risk. The equity tranche is the first loss tranche. A small default rate of 3–4% in the high-yield collateral securities would wipe out nearly a third of the equity tranche.

Motivations for a Manager of an Arbitrage CDO

LO 27.3: Demonstrate knowledge of the mechanics of and motivations for arbitrage CDOs.

For example:
- **Identify the three direct financial motivations for a manager of an arbitrage CDO.**

A money manager can profit from an arbitrage CDO in at least three ways:

1. *A transaction fee from selling the high-yield portfolio to the trust.* The money manager earns this fee as compensation for assembling a large portfolio of high-yield bonds of the appropriate credit rating.

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2. *A management fee for managing the CDO collateral portfolio.* The sponsor of a CDO is typically also the manager of the CDO trust, and so additionally earns a fee for managing this portfolio. The money manager will charge an annual management fee (often on the order 0.5%) for managing the trust's assets.

3. *The return or spread on the equity tranche.* The money manager usually invests in the equity of the CDO. Because residual income earned by a CDO falls into the equity tranche, the money manager will earn the difference between the income on the CDO's collateral versus the amount that is paid out on the CDO notes. Note that this return is not a true arbitrage return, as much of the return is compensation for taking on credit risk. However, the holders of highly-rated investment-grade tranches are often willing to accept relatively low coupons, which leads to high expected returns for the equity tranche.

In addition to the above, managers of CDOs that believe they possess superior security-selection ability may be motivated to invest in arbitrage CDOs with the expectation that their portfolio management abilities will result in superior credit-worthiness and higher income.

Cash-Funded CDOs vs. Synthetic CDOs

LO 27.4: Demonstrate knowledge of cash-funded CDOs and synthetic CDOs.

For example:
- **Compare and contrast cash-funded CDOs and synthetic CDOs.**
- **Explain how a cash-funded CDO can be used to reduce required regulatory capital.**
- **Apply a typical cash-funded CDO structure.**
- **Describe the characteristics of synthetic CDOs.**

In addition to categorizing CDOs as either balance sheet or arbitrage CDOs, CDOs can be categorized as being cash-funded or synthetic. In Figure 2, the various types of CDOs are listed. Note that synthetic CDOs can be found under both balance sheet CDOs and arbitrage CDOs. In the following pages, we will cover all of these CDO types, but you may want to refer back to this figure to help you understand where each type falls in the CDO hierarchy.

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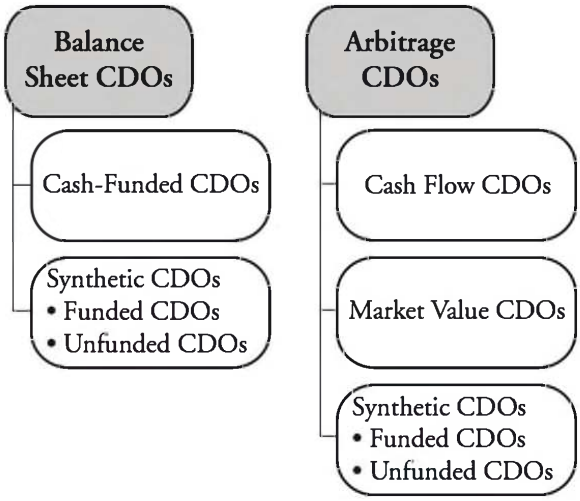
Figure 2: Various Types of CDOs



In a synthetic balance sheet CDO, the SPV does not invest in the underlying assets. Instead, the SPV gains exposure to the assets by using credit derivatives. Typically, the total return profile of the basket of loans or other assets is transferred to the SPV through the use of a credit default swap or a total return swap.

The key differences between cash-funded and synthetic balance sheet CDOs are:

- *Ownership.* In a cash-funded CDO, the ownership of assets is transferred to the SPV. In a synthetic CDO, the bank transfers the assets' risk profile but retains legal ownership of the assets.
- *Use of proceeds from the sale of tranche securities.* In a cash-funded CDO, the SPV uses the proceeds from the sale of the CDO tranche securities to purchase the loans and bonds used as collateral. In a synthetic CDO, the proceeds are used to purchase U.S. Treasury securities, which are in turn used to fund the swap payments to the bank.

Characteristics of Cash-Funded CDOs

In a **cash-funded CDO**, the seller of the assets is typically a bank that wants to remove a portion of its loan portfolio from its balance sheet. The bank will construct an SPV, and the SPV will hold the actual securities that are used to generate payment to the tranches. The term *cash-funded* means that the CDO is constructed by the actual sale and transfer of assets to the SPV. The result is that the risky assets from the bank's balance sheet are replaced by cash.

The advantages of a cash-funded CDO are:

- *Reduction of required regulatory capital.* Banks are required to hold regulatory capital as a percentage of the outstanding balance on loans. The amount of capital required depends on the risk of the assets. Regulatory capital is raised through the issuance of common stock and other forms of financing, which may be expensive as compared to deposits. By using a cash-funded CDO, the bank can reduce the amount of regulatory capital required.
- *Use proceeds to make additional loans or to pay down liabilities.* The cash proceeds from the sale of the loans to the CDO trust can be used to pay down liabilities and improve a bank's balance sheet or as funds to make additional loans.

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- *Reduce credit exposure to a particular borrower or industry.* A cash-funded CDO can also be used to remove or reduce exposures to a specific borrower or an industry. The bank may provide multiple services to a specific client and wish to continue making loans to the client even though the bank has a higher-than-desired credit exposure to the borrower. The bank can continue making loans and use a cash-funded CDO to reduce or remove the exposure to the borrower in order to maintain the relationship.

Example: Cash-funded CDOs and regulatory capital

Assume a bank has $200 million in commercial loans to an industry that it would like to remove from its balance sheet. If the regulatory capital requirement is 10% of the loan balance, how much regulatory capital would the bank free up by selling the loans to a CDO SPV?

Now assume that the bank is required to retain the $4 million equity tranche from the CDO in order to secure additional investors in the CDO. The bank is required to hold regulatory capital one-for-one on the equity tranche. How much regulatory capital would the bank free up in this case?

Answer:

The bank would free up $20 million (= $200 million × 10%) by removing the loans from its balance sheet.

The requirement to hold the equity tranche would result in the bank being able to free up $16 million (= $200 million × 10% – $4 million) in regulatory capital.

Characteristics of Synthetic CDOs

A **synthetic CDO** is created by using either total return swaps or credit default swaps. The most common form of synthetic CDO uses credit default swaps. By using credit derivatives, the ownership of the assets is not transferred. Only the economic exposure is transferred. The economic exposure is created by the synthetic CDO selling credit protection for a reference portfolio. As compensation for selling the credit protection, the CDO receives CDS payments from the credit protection buyer. The CDS payments are then paid to CDO tranches in order of the CDO waterfall.

The CDS payments represent only the credit spread of the underlying portfolio. The remaining return is added to the CDO through the purchase of low risk collateral such as U.S. Treasury securities. The cash collected from the sale of CDO tranches is invested in the low risk collateral and earns interest. Combined, the interest and CDS payments create a total return that is nearly equivalent to the total return from ownership of the reference portfolio.

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Professor's Note: Within the category of synthetic CDOs, there are funded and unfunded CDOs. In a funded CDO, the investors purchase CDO securities, and the proceeds are used to purchase low-risk securities such as U.S. Treasuries. The credit exposure is then added through credit default swaps (CDSs). In the event of a default, the CDO manager would sell some of the low-risk securities to make the CDS payment. The synthetic CDO described above is a funded CDO.

In an unfunded CDO, the investors do not pay a purchase price for CDO securities but act as the credit protection seller. The investor receives payments from the CDO in exchange for providing credit protection. In the event of a default, the investors will be required to make a payment. Unfunded CDOs serve as an intermediary between investors who want to increase credit risk exposure and asset owners who want to hedge credit risk through the use of CDSs.

Synthetic CDOs can be either balance sheet or arbitrage CDOs. In the case of a balance sheet CDO, the bank retains physical ownership of the underlying portfolio and transfers the economic risk of the portfolio to the CDO through a CDS. Synthetic arbitrage CDOs allow an investment manager to create an arbitrage CDO without having to take physical ownership of the underlying portfolio.

Advantages of using a synthetic CDO as an arbitrage CDO include:

- *Avoids the transfer of assets.* A synthetic CDO avoids the difficulties that can result from transferring assets. Some commercial loans may require the consent of the borrower before they are sold to another party, which takes time and increases administrative costs, making the synthetic CDO easier to create relative to a balance sheet CDO.
- *Less burdensome.* Financial institutions create synthetic arbitrage CDOs with the goal of profiting from the difference in the returns from the collateral portfolio and the CDO securities. By not requiring the transfer of assets, the synthetic structure is less burdensome.
- *Scarce assets.* In some cases, the underlying assets may be scarce and difficult to acquire. The synthetic CDO eliminates the issues of finding the underlying assets because the credit exposure is added through derivatives.
- *Use of leverage.* The use of credit derivatives gives a synthetic CDO the ability to use leverage to enhance returns. A cash-funded CDO does not use leverage since it simply passes through the cash received from the collateral to the securities in the CDO structure.

Cash Flow CDOs vs. Market Value CDOs

LO 27.5: Demonstrate knowledge of cash flow and market value CDOs.

For example:
- **Describe the characteristics of cash flow CDOs**
- **Describe the characteristics of market value CDOs**

As shown in Figure 2, arbitrage CDOs can be subdivided into cash flow, market value, and synthetic CDOs. Synthetic CDOs were addressed previously in this topic. The difference between cash flow and market value CDOs has to do with whether (1) the maturities

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of CDO assets and liabilities are matched (i.e., a cash flow CDO) or (2) the portfolio is actively traded to generate a higher return (i.e., a market value CDO). These categories of CDOs do not appear within the balance sheet CDO because the bank or financial institution selling the portfolio chooses the assets.

Characteristics of Cash Flow CDOs

The proceeds from the sale of a **cash flow CDO** are used to acquire the underlying assets. These portfolio assets may be held until maturity, but are more often actively managed by the CDO trust manager. Cash flow CDOs have fixed maturities that match the maturities of the underlying assets. Attention is paid to match the cash inflows of the portfolio assets with the outflows to the CDO tranches. The goal for cash flow CDOs is to minimize defaults by managing the credit quality of the assets held.

Characteristics of Market Value CDOs

The underlying portfolio in a **market value CDO** is actively managed. Unlike cash flow CDOs, market value CDOs do not attempt to match the cash flows of assets and liabilities. Instead, market value CDOs focus on managing the volatility of the underlying assets in order to maintain the value of the portfolio. Liabilities are paid through a combination of the cash flows from the collateral and from the active trading of the collateral. Market value CDOs, therefore, focus on total return (i.e., the interest and the capital return).

Credit Risk and Enhancements

LO 27.6: Demonstrate knowledge of credit risk and enhancement of CDOs.

For example:
- **Define and discuss subordination as an internal credit enhancement.**
- **Discuss and apply overcollateralization.**
- **Describe excess spread as an internal credit enhancement.**
- **Discuss reserve accounts as a credit enhancement.**
- **Describe external credit enhancements to CDOs.**

Credit enhancements are methods used to improve the credit riskiness of a CDO or a tranche in a CDO structure to ensure that a certain credit rating is received. Credit enhancements are either internal or external enhancements. An **internal credit enhancement** is an enhancement made inside the structure of the CDO. Credit enhancements by definition are made to improve credit ratings, therefore, credit enhancements will lead to lower coupon rates for CDO securities.

Subordination as Credit Enhancement

The most common form of credit enhancement is subordination. **Subordination** is an internal credit enhancement that occurs through the structuring of the CDO with subordinated tranches (i.e., tranches with lower seniority), so that senior tranches receive credit enhancement. Subordinated tranches absorb credit losses before senior tranches and, therefore, provide protection to the more senior tranches.

In the case of a simple CDO with only three tranches (a senior tranche, a mezzanine tranche, and an equity tranche), the equity tranche provides protection to both the senior

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and mezzanine tranches, and the mezzanine tranche provides protection to the senior tranche. For bearing higher credit risk, the equity and mezzanine tranches will receive lower credit ratings and higher coupon rates.

In addition to credit protection, subordination also provides protection to the timing of payments. Cash flows are paid to the CDO tranches following the order of the cash flow waterfall (i.e., the senior tranche is paid first, then the mezzanine, and then the equity). If there is insufficient cash flow to pay all of the CDO securities due to timing, the senior tranche will be paid first, and the remaining tranches must wait until there is sufficient cash flow.

Overcollateralization as Credit Enhancement

Overcollateralization occurs when the value of the collateral exceeds the value of the liabilities. In a CDO, overcollateralization is an internal credit enhancement that occurs through the subordination process—the proceeds from the lower level tranches are used to purchase underlying assets that have a greater value than the senior tranche. For example, a CDO issues two tranches: a senior tranche at $40 million and an equity tranche at $10 million. The CDO then purchases $50 million of underlying assets. The overcollateralization of the senior tranche is 125% (= $50 / $40).

Excess Spread as Internal CDO Enhancement

Excess spread, another form of internal credit enhancement, occurs when the yield on the underlying assets of a CDO is greater than the yield on the CDO securities. This may occur if the credit quality of the underlying assets is lower than the CDO securities or if there is a term structure mismatch. This spread creates a cushion for the CDO trust, which can be used to cover any losses and is referred to as **spread enhancement**.

Reserve Account as a Credit Enhancement

A **reserve account** consists of excess cash invested in highly rated securities. A reserve account is a form of internal credit enhancement. The reserve account assets reduce the risk of the assets held by the CDO trust, but also reduce the return. Reserve accounts are common during the ramp-up period of a CDO when cash has been collected from the sale of the CDO securities but has not been invested in CDO collateral.

External CDO Credit Enhancements

Insurance on the CDO trust's portfolio can be acquired through an outside third party in the form of a standard insurance contract, a put option, or a credit default swap. These are considered **external credit enhancements** because the enhancement is created outside of the CDO trust.

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New Developments in CDOs

LO 27.7: Demonstrate knowledge of new developments in CDOs.

For example:
- **Describe distressed debt CDOs.**
- **Describe hedge fund CDOs.**
- **Describe single-tranche CDOs.**

The use of the CDO structure has expanded beyond high-yield bonds, mortgages, and loans to include distressed debt, hedge funds, collateralized commodity obligations, private equity, and other CDOs (i.e., a CDO squared). Below is a discussion of new developments in CDOs including distressed debt CDOs, hedge fund CDOs, and single-tranche CDOs.

Distressed Debt CDOs

Distressed debt CDOs use distressed debt (i.e., securities already in default or expected to default) as the primary collateral component. Distressed debt CDOs came about because increased default rates in 2000–2001 and in 2008 led to increased interest in distressed debt investing.

The CDO structure can provide a series of tranches of collateralized securities that have an investment grade credit rating, even though the underlying collateral is of speculative grade. Distressed debt CDOs benefit investors by giving them the ability to access the distressed debt asset class at a level that matches their risk preference. The primary suppliers for distressed debt CDOs are banks.

There are three major reasons why banks participate in distressed debt CDOs:

1. Non-performing assets are removed from their balance sheets.

2. Regulatory capital requirements are reduced.

3. The banks' liquidity is improved through the cash received from the sale of the collateral.

Hedge Fund CDOs

Hedge fund CDOs, also referred to as **collateralized fund obligations (CFOs)**, utilize the CDO structure to invest in a pool of hedge funds. CFOs gained popularity during the hedge fund boom that preceded the 2007–2008 credit crisis. One of the primary benefits of CFOs is the access to risk and return sources that may not otherwise be available due to difficulties such as minimum investment restrictions.

Single-Tranche CDOs

Single-tranche CDOs only sell one tranche from the capital structure of a CDO, with the sponsor of the CDO trust keeping the rest of the tranches on its balance sheet. The single-tranche CDO works like a normal synthetic CDO by using a CDS to transfer risk exposure. However, only a specific portion of the collateral portfolio's risk is transferred to investors. The advantages of a single-tranche structure are customization and a singular cash flow recipient. Investors have control over collateral composition, maturity, and credit rating.

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There is no waterfall cash flow pattern since all cash flows are distributed to the single-tranche CDO investors.

Risks of CDOs

LO 27.8: Demonstrate knowledge of the risks of CDOs.

For example:
- **Recognize the risk of the underlying collateral.**
- **Recognize the financial engineering risk.**
- **Discuss the implications of high correlations among the underlying assets.**
- **Define risk shifting, and discuss its implications for CDOs.**
- **Describe how CDO credit risk can be modeled.**

There are significant risks associated with CDOs as illustrated by the recent credit crisis. The major risks associated with CDOs are addressed in the following sections.

Risks of the Underlying Collateral

The biggest risk driver in a CDO is the risk of the underlying collateral portfolio. The risk of the underlying portfolio is unchanged by the CDO structure. It is merely transferred to the tranches in varying levels based on seniority. Additionally, the risk of the portfolio can change over time due to changes in market condition (e.g., credit crisis) or changes in the portfolio holdings. The effects of a credit crisis may not be immediately reflected, as CDO managers could be slow to write-off poorly performing assets.

The collateral portfolio is exposed to credit spread risk, downgrade risk, and default risk. Loss given default is also an important consideration to the performance of the CDO. A low recovery rate (i.e., high loss given default) combined with a high rate of default will result in substantial losses for the CDO investors.

Financial Engineering Risk

CDOs are securities that are created though financial engineering. Underlying subprime mortgages are packaged into mortgage-backed securities (MBSs) and then into CDOs where the risks are divided among tranches. The pricing of CDOs relies on the models used in the financial engineering. If default rates on subprime mortgages are higher than anticipated, the pricing model becomes questionable. The potential for losses resulting from securitization and the structuring of cash flows is **financial engineering risk**.

The risk of financial engineering was seen in the CMO market in 1994 when rising interest rates caused many entities to fail. Financial engineering risk came to the forefront again in 2007 and 2008 when AAA-rated CDO securities experienced losses that should not have occurred based on the credit rating received through the CDO process.

Other CDO Risks

There are a number of additional potential risks that a CDO portfolio manager should be aware such as mismatched payment dates, basis risk, spread compression risk, and yield curve risk.

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Payment periodicity refers to the schedule of payments from the underlying collateral. These payments may not match the schedule of payments to be made on the CDO securities. For example, the collateral may pay interest quarterly, while the CDO security payments may be paid semi-annually. Depending on the direction of the schedule mismatch, the trust may have a problem resulting from the negative carry of holding reserve interest payments or from an interest shortfall. In most cases, these periodicity mismatches can be solved through the use of a swap agreement with an outside party, whereby the CDO swaps the mismatched cash inflows for a stream of cash flows that align with the CDO's cash outflows.

Basis risk is a concern if the index used for determining interest earned on the CDO collateral is different from the index used to pay interest on the CDO trust securities. For example, the interest paid on bank loans may be tied to LIBOR, while the interest paid on other assets may be tied to the T-bill rate. One way to solve this problem is to issue a portion of the tranches with a fixed interest rate, which will prevent the required securities from being impacted by the underlying index.

Spread compression risk occurs when credit spreads decline over time. This is particularly a problem for arbitrage CDOs. As the CDO collateral securities mature, the portfolio manager will be forced to purchase securities with smaller credit spreads, which will reduce the amount of interest received by the CDO trust. Receiving a lower credit spread will reduce both the net income spread from the CDO and the manager's profits.

Yield curve risk is the potential for losses resulting from changes in the yield curve. If the collateral assets in a CDO trust have multiple maturity ranges, the portfolio will be impacted by changes in the shape, slope, or level of the yield curve. Changes in the yield curve shape may increase or decrease the interest spread between the collateral portfolio and the CDO tranche securities, thus changing the potential for arbitrage profits.

Implications of High Correlations among Underlying Assets

CDOs are sometimes called correlation products because CDO risk exposure is tied to the default of more than one debt security, and the overall risk of the portfolio is driven by the correlation between these securities. This risk is known as **correlation risk**. Correlation risk increases as asset correlation increases, and can lead to major losses if many securities default at the same time. If default risk is instead diversified, default losses are unlikely to impact senior tranches.

Risk Shifting Implications for CDOs

An increase in the risk of CDO collateral has a unique effect on the tranches of a CDO—the value of the senior tranche will decrease, while the value of the equity tranche will increase. This effect is known as risk shifting. **Risk shifting** occurs when there is an unequal effect on the values of related securities from a change in risk.

The equity tranche can be modeled as a call option, the mezzanine tranche as a bull call spread, and the senior tranche as a risk-free security with a short put option. From option theory, we know that options increase in value when risk (i.e., volatility) increases. Based on this, an increase in risk would lead to an increase in the value of the equity and mezzanine tranches and a decrease in value for the senior tranche.

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A CDO issuer and the investors in CDO securities have interests that conflict. The CDO issuer wants to remove assets from its balance sheet, while receiving as much as possible from the sale of the assets. There is an incentive for the CDO issuer to sell securities with credit quality lower than promised. Since the manager of a CDO is often the issuer of the CDO and because of other moral hazards are faced by the manager of a CDO, the manager will frequently retain a portion of the equity tranche. This, however, does not resolve the conflict of interest since the equity tranche benefits from increases in risk at the expense of the senior tranche.

CDO Credit Risk Modeling

Traditional asset pricing models that focus on systematic risk (i.e., beta), such as the capital asset pricing model (CAPM), cannot be used to model and price credit risk. The properties of credit risk, which are different from the properties of other types of risk, require unique pricing models. There are four properties of credit risk that limit the usefulness of traditional asset pricing models:

1. Defaults are relatively rare events with a limited history of observations available to estimate traditional risk measures.

2. Defaults are binary events whose occurrence may be observationally equivalent to several competing hypotheses. For example, a default is consistent with deteriorating macroeconomic conditions, as well as the poor business decisions of management.

3. Financial institutions that bear credit risk are unlikely to fully diversify their credit exposure and thus retain idiosyncratic credit risk.

4. Credit risk may not only be a function of the counterparty's ability to pay but also its willingness. This is particularly true for sovereign borrowers.

CDO losses are driven by the default rate and the loss rate, where the default rate is the percentage of the collateral portfolio experiencing default and the loss rate is the percentage of the securities in default that cannot be recovered. The most frequent method for modeling default risk in CDOs is to use a copula approach.

A copula is a concept from statistics and probability theory that describes the dependence of random variables on each other. In the case of CDOs, the asset value is derived through the value of the underlying collateral portfolio. A **copula approach** is used to incorporate the interdependency between the underlying portfolio securities when modeling defaults. The modeling of the credit risk of the collateral securities can be divided into two components: an idiosyncratic factor and a market risk factor. The idiosyncratic factor represents the issue-specific risks that result in default of a given issue, while the market risk factor reflects common risk factors and the tendency of defaults to occur at the same time.

A copula approach has been commonly used in the credit assessments of CDOs by rating agencies, and after the 2007 credit crisis, the approach came under attack as a possible cause of the mis-estimation of credit risk.

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Key Concepts

LO 27.1

The first CDOs, originally called collateralized bond obligations (CBOs), were issued in the late 1980s with the repackaging of high-yield bonds. In the 1990s, collateralized loan obligations (CLOs) were used to repackage loans.

The three periods of a CDO lifecycle include:

1. Ramp-up period, where the CDO manager builds the collateral portfolio.

2. Revolving period, where the CDO manager reinvests cash flows and manages the portfolio.

3. Amortization period, where principal payments are made to CDO security holders.

A special purpose vehicle (SPV) is used to hold the assets in a CDO structure and is legally separate from the CDO sponsor (i.e., bankruptcy remote).

The underlying pool of assets held in the CDO trust is the reference portfolio or collateral pool. The weighted average rating factor (WARF) is the average credit rating of the reference portfolio. The weighted average spread (WAS) is the average spread over LIBOR of the reference portfolio. The diversity score measures the number of uncorrelated assets in the reference portfolio. Tranche width is the size of a tranche represented as a percentage of the total CDO and can be calculated as the difference between the attachment and detachment points.

LO 27.2

A balance sheet CDO is used by a financial institution such as a bank or insurance company to remove assets from its balance sheet. There are generally three goals of a balance sheet CDO:

1. Reduce credit exposure to a certain client or industry.

2. Capital infusion (i.e., improve liquidity).

3. Reduce regulatory capital charges.

Arbitrage CDOs are issued primarily by money managers who are seeking to earn an arbitrage profit between the return on the collateral and the funding costs of the CDO. A money manager can profit from an arbitrage CDO in three ways:

1. A transaction fee from selling portfolio.

2. The CDO management fee.

3. The return from holding the equity tranche.

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LO 27.3

Three direct financial motivations for a manager of an arbitrage CDO are:

1. Earning a transaction fee for assembling a portfolio of high-yield bonds and selling it to the trust.

2. Earning an annual management fee for managing the CDO collateral portfolio.

3. Earning a return on the equity tranche, reflecting the difference between the income on the CDO's collateral versus the amount that is paid out on the CDO notes.

CDO managers may also believe that their security-selection ability will result in higher income.

LO 27.4

A cash-funded CDO involves the actual sale and transfer of ownership of the referenced assets to the SPV. The advantages of a cash-funded CDO are:

- Reduction of required regulatory capital.
- Proceeds can be used to make additional loans or to pay down liabilities.
- Reduction of credit exposure to a particular borrower or industry.

A synthetic CDO avoids the transfer of the underlying assets by using either total return swaps or credit default swaps. Synthetic CDOs that use credit default swaps are often called correlation products. Synthetic CDOs can be either balance sheet or arbitrage CDOs. Advantages of using a synthetic CDO as an arbitrage CDO include:

- Avoids the transfer of assets.
- Less burdensome.
- Eliminates need to find and transfer scarce assets.
- Use of leverage.

LO 27.5

Cash flow CDOs are typically actively managed and have fixed maturities. The goal of a cash flow CDO is to minimize defaults by managing the credit quality of the assets held.

Market value CDOs trade underlying securities and do not have a fixed maturity. The goal of a market value CDO is to manage the volatility of the underlying assets in order to maintain the portfolio's value.

LO 27.6

Credit enhancement (which can be either internal or external) is a method of altering the risk of a CDO to improve the credit risk of the CDO. An internal credit enhancement occurs within the structure of a CDO.

Internal credit enhancements include:

- Subordination occurs through the structuring of the CDO with subordinated tranches (i.e., tranches with lower seniority). Subordinated tranches absorb losses first, providing protection to the senior tranche.

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- Overcollateralization occurs when there is more CDO collateral held in the SPV than CDO securities issued.
- Spread enhancement occurs when there is excess spread—the yield on the underlying assets of a CDO is greater than the yield on the CDO securities.
- Reserve accounts include cash or highly rated securities and reduce the overall risk of the CDO collateral.

External credit enhancement to a CDO can be achieved through an insurance contract, a put option, or a CDS.

LO 27.7

New developments in CDOs use different forms of collateral in a CDO structure to create exposure to different asset classes and cash flow patterns:

- Distressed debt CDOs use distressed debt as the primary collateral component and can provide a series of tranches that have an investment grade credit rating even though the underlying collateral has a speculative grade.
- Hedge fund CDOs, which are also called collateralized fund obligations (CFOs), are backed by hedge funds of various strategies.
- Single-tranche CDOs work like a normal synthetic CDO by using a CDS to transfer risk exposure. However, only a specific portion of the collateral portfolio's risk (i.e., a single tranche) is transferred to investors.

LO 27.8

Key risks associated with CDOs include:

- Underlying collateral risk (most important risk). The risk of the underlying collateral is transferred to the CDO securities in varying levels based on seniority.
- Financial engineering risk. The risk that is inherent in the structuring and creation of innovative financial project.
- Differences in interest payment periodicity and differences in interest payment dates.
- Basis risk. If the indices used to determine the payments to the CDO collateral and to the CDO securities are different, then the CDO is exposed to the risk that these indices will not be perfectly correlated.
- Spread compression risk. For managed CDOs, this can be troublesome as new collateral will be purchased with lower credit spreads, reducing the interest received by the CDO trust.
- Yield curve risk. If there are multiple maturities within the collateral portfolio, a change in the shape or slope of the yield curve will affect the interest received from collateral.

High correlations among underlying assets can lead to the simultaneous default of more than one CDO security. Correlation risk increases as asset correlation increases and can lead to major losses if many securities default at the same time. If default risk is diversified, default losses are unlikely to impact senior tranches.

Risk shifting in a CDO occurs when there is a change in the risk of the underlying collateral, which results in an unequal effect on the values of senior and junior tranches. For instance, an increase in the volatility of the underlying collateral will result in an increase in the value of an equity tranche and a decrease in the value of the senior tranche.

A copula approach is commonly used to model CDOs as it incorporates the interdependencies in the credit risk of the underlying assets.

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Concept Checkers

1. Which of the following statements regarding special purpose vehicles (SPVs) is **FALSE**? SPVs:
   A. are separate legal entities from the firm sponsoring the CDO.
   B. have high credit risk due to their issuance of CDO tranches.
   C. are the legal owners of collateral placed in a balance sheet CDO trust.
   D. do not provide recourse for a creditor who is looking to collect from a CDO sponsor that has gone bankrupt.

2. The weighted average rating factor (WARF) is *most likely* used to measure the average:
   A. credit rating of collateral in the CDO trust.
   B. spread over LIBOR of collateral in the CDO trust.
   C. credit rating for the CDO senior tranche across time.
   D. spread of the CDO senior tranche relative to LIBOR across time.

3. Which of the following is *least likely* a major goal for a balance sheet CDO?
   A. Reduce credit exposure to individual clients.
   B. Improve liquidity through a capital infusion.
   C. Reduce regulatory capital charges.
   D. Earn the spread between collateral income and CDO security payout.

4. The Elias Company is considering selling securities to a CDO trust to create an arbitrage CDO. Which of the following is the *most likely* description of Elias Company's line of business and purpose of establishing the CDO trust? Elias company is a(n):
   A. bank that wants to generate an arbitrage profit.
   B. bank that wants to remove risk exposure from balance sheet.
   C. asset management firm that wants to generate an arbitrage profit.
   D. asset management firm that wants to remove risk exposure from balance sheet.

5. Which of the following is *least likely* to represent a financial motivation for the manager of an arbitrage CDO?
   A. Earning a transaction fee for selling a high-yield bond portfolio to the CDO trust.
   B. Earning a fee for managing the CDO collateral portfolio assets.
   C. Receiving the return or spread on the equity tranche.
   D. Receiving a capital infusion in exchange for credit-risky assets.

6. Regarding the differences between a cash-funded CDO and a synthetic CDO, the synthetic CDO requires:
   A. an investment in the underlying assets and has less operational risk.
   B. an investment in the underlying assets and has more operational risk.
   C. no investment in the underlying assets and has less operational risk.
   D. no investment in the underlying assets and has more operational risk.

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7. Millennium Bank has a $350 million loan portfolio that it wishes to sell to a collateralized loan obligation (CLO) trust. The bank uses a cash-funded balance sheet CDO where the trust sells $335 million of investment grade securities to investors, while the bank retains the equity tranche of the CLO, which is valued at $15 million. The bank was required to hold an 8% capital charge prior to the CLO and must maintain capital one-for-one with the equity tranche. How much regulatory capital did Millennium Bank free by selling loans to the CLO trust?
   A. $11.8 million.
   B. $13.0 million.
   C. $26.8 million.
   D. $28.0 million.

8. Which of the following statements concerning cash-funded and synthetic balance sheet CDOs is *most accurate*?
   A. Legal ownership of the collateral assets transfers in a cash-funded CDO, but not in a synthetic CDO.
   B. Both cash-funded and synthetic CDOs use leverage to enhance return for the CDO security holders.
   C. Cash-funded CDOs use the proceeds from the sale of collateral securities to purchase Treasury bonds, while synthetic CDOs use the proceeds to make payments on credit default swaps.
   D. Administrative costs tend to be higher with synthetic CDOs than cash-funded CDOs.

9. A CDO that does not have a fixed maturity and trades the underlying collateral with the goal of reducing volatility while focusing on total return is *most likely* a:
   A. cash flow arbitrage CDO.
   B. market value arbitrage CDO.
   C. synthetic arbitrage CDO.
   D. synthetic balance sheet CDO.

10. The internal credit enhancement that results from issuing CDO securities worth less than the portfolio held by the CDO trust is *most likely*:
   A. a reserve account.
   B. spread enhancement.
   C. overcollateralization.
   D. subordination.

11. Which of the following statements regarding hedge fund CDOs is *most accurate*? Hedge fund CDOs:
   A. invest in collateralized commodity obligations.
   B. provide diversification to hedge fund investors.
   C. are hedge funds that primarily invest in CDOs.
   D. utilize hedge fund investments as the collateral pool for CDOs.

12. Which of the following is **NOT** one of the key risks associated with CDOs?
   A. Credit spread extension risk.
   B. Basis risk.
   C. Differences in interest payment dates.
   D. Changes in the slope of the yield curve.

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Concept Checker Answers

1. **B** SPVs typically have low credit risk because they hold the CDO collateral securities and transfer any risk to CDO investors through the sale of tranche securities. The other statements are true. One of the key attributes of a SPV is the fact that it is bankruptcy remote, which means that the assets in the SPV are secure from any financial difficulties suffered by the bank or brokerage firm sponsoring the CDO. (LO 27.1)

2. **A** The weighted average rating factor (WARF) measures the average credit rating of the collateral in a CDO trust. The weighted average spread (WAS) measures the average spread of the collateral in a CDO trust over LIBOR. (LO 27.1)

3. **D** There are generally three goals of a balance sheet CDO:
   1. Reduce credit exposure to a certain client or industry.
   2. Capital infusion (i.e., improve liquidity).
   3. Reduce regulatory capital charges. (LO 27.2)

4. **C** The key here is that the question stated that Elias Company wanted to establish an arbitrage CDO. Arbitrage CDOs are typically constructed by money management firms who want to generate an arbitrage profit from the difference in interest received from the CDO collateral securities and the interest paid to investors in the CDO tranches. (LO 27.2)

5 **D** Financial institutions would use a balance sheet CDO—not an arbitrage CDO—to divest assets in exchange for cash. Arbitrage CDOs provide money managers at least three profit opportunities including (1) earning a transaction fee for selling a portfolio of high-yield bonds to the CDO, (2) earning an annual fee for managing the CDO portfolio assets, and (3) earning a return for holding the CDO equity tranche. (LO 27.3)

6. **C** In a cash-funded CDO, the SPV invests in the securities that are used to generate payments to the tranches. In a synthetic CDO, the SPV does not invest in the underlying securities. It gains exposure to these securities by selling a credit default swap (CDS). The premium from the CDS and the funds from the sale of the tranches are used to buy a risk-free bond. The SPV does not have operational risk in the original assets in synthetic CDO since there is no transfer of ownership. In cash-funded CDOs, the sale and transfer of assets can create administrative complications. (LO 27.4)

7. **B** Millennium Bank sells $350 million worth of loans to the CLO trust, which would ordinarily result in a risk-based regulatory capital savings of 8% of $350 million, or $28 million. However, by maintaining the equity tranche of the CDO structure, the bank has a first-loss position of $15 million. According to the terms of the Basel Accord, Millennium must take a one-for-one capital charge for this first loss position. This means that only $28 – $15 = $13 million of regulatory capital will be freed by the CLO trust. (LO 27.4)

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8. **A** Legal ownership of the securities is transferred in a cash-funded balance sheet CDO, but in a synthetic balance sheet CDO, the bank maintains legal ownership of the collateral securities. Note that the other statements are incorrect. Only synthetic CDOs use leverage. Synthetic CDOs use proceeds from the sale of CDO securities to purchase T-bonds to help fund swap payments, while a cash-funded CDO uses the proceeds from the sale of securities to fund the purchase of the collateral pool from the bank. Since the synthetic CDOs do not involve the transfer of ownership, they typically have lower administrative costs when compared to cash-funded CDOs. (LO 27.4)

9. **B** A market value arbitrage CDO is an actively managed CDO that typically does not have a fixed maturity. The goal of a market value CDO is to manage the volatility of the underlying assets as the focus is on total return. (LO 27.5)

10. **C** Overcollateralization occurs when there is more CDO collateral held in the SPV than CDO securities issued. Subordination is an internal credit enhancement that occurs through the structuring of the CDO with subordinated tranches. Spread enhancement occurs when there is excess spread. A reserve account includes cash or highly rated securities and reduces the overall risk of the CDO collateral. (LO 27.6)

11. **D** Hedge fund CDOs are backed by hedge fund investments and are referred to as collateralized fund obligations. They provide diversification to CDO investors due to the low correlation of hedge funds with debt. (LO 27.7)

12. **A** One of the key risks of CDOs is credit spread compression risk, not extension risk. Compression risk occurs when credit spreads decline over time and the investment manager is forced to invest in lower yielding securities, which decrease the interest received by the CDO trust. A widening of credit spreads would increase interest income for the CDO trust and would be a positive occurrence. (LO 27.8)

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The following is a review of the Structured Products principles designed to address the learning objectives set forth by the CAIA Association®.

Equity-Linked Structured Products

Topic 6.4

Exam Focus

This topic review looks at different types of structured products and discusses how various features in these products can affect risk exposure and investor returns. Be sure you can calculate the effects of different tax strategies on investor returns. Understand the different types of exotic options used with structured products. Be aware of the different approaches to pricing structured products and the advantages and disadvantages of each. Finally, understand the motivations of both investors and issuers with regard to structured products.

Structured Products

LO 28.1: Demonstrate knowledge of structured products and types of wrappers.

For example:

- **Describe equity-linked structured products.**
- **List distinguishing features of equity-linked structured products.**
- **Define a wrapper.**
- **Describe the six types of wrappers.**

Structured products are securities created from a single investment or a number of investments with differing characteristics. In the broad sense, structured products are designed to meet investor demand for securities that have characteristics that cannot be met with basic stocks, bonds, or other investments. Many structured products focus on matching risk exposure from a pool of assets to an investor or issuer's preferences.

Equity-linked structured products are collateralized by low risk assets, such as a certificate of deposit (CD) guaranteeing a minimum level of return and then providing additional upside by tying returns to a risky asset, such as a market index. Unlike collateralized mortgage obligations (CMOs) and other structured products, equity-linked structured products (1) are collateralized by low-risk assets or asset pools, (2) are created to meet investor preferences for risk and other investment characteristics and to generate fees to the issuer, and (3) have features that go beyond simple risk exposure allocation.

A **wrapper** is the structure in which the product is organized. A wrapper is a legal contract between the issuer and investor and lays out specific terms of the equity-linked structured product. Wrappers usually have some benefit to investors such as reduced taxes, default protection, or access to restricted investments.

Six types of structured product wrappers are:

1. **Over-the-counter (OTC) contracts** are legally binding private agreements between two parties to purchase/deliver securities at a specific price and date.

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2. **Medium-term notes/certificates/warrants** are based on public or private obligations. Typically, they are low cost and publicly traded.

3. **Funds** are pooled investments that seek to match a structured product. Funds are often publicly traded and may provide investors tax benefits.

4. **Life insurance policies** often provide deferred or reduced tax obligations.

5. **Structured deposits** are instruments such as CDs issued by a bank.

6. **Islamic wrappers** follow guidelines allowed under shari'a law (the Islamic legal system) including prohibitions against certain types of investments and charging interest.

Tax Effects

LO 28.2: Demonstrate knowledge of potential tax effects of wrappers.

For example:
- **Describe the tax effects of wrappers.**
- **Apply the equations in the chapter to demonstrate the tax effects of wrappers.**

Many wrappers offer tax benefits to investors. There are four types of tax structures from wrappers:

- Tax-free.
- Fully-taxed.
- Tax-deferral.
- Tax deferral and tax deduction.

Tax-Free Wrappers

Tax-free investments allow investors to avoid paying taxes on any gains or distributions from an investment. Investment contributions, however, are not deductible. In the United States, a Roth individual retirement account (IRA) is one type of tax-free wrapper. In the United Kingdom, an individual savings account (ISA) offers the same benefits. In a tax-free investment, the after-tax return equals the investment return, as in the following equation:

$$r^* = r$$

where:
r^* = after-tax return on investment
r = pre-tax return on investment

Fully Taxed Wrappers

Fully taxed investments are investments where distributions and gains are taxable when they are received. In a fully taxed investment, the after-tax return equals the investment return less applicable taxes, as in the following equation.

$$r^* = r\,(1 - T)$$

where:
r^* = after-tax return on investment
r = pre-tax return on investment
T = tax rate

Example: After-tax return on a fully-taxed investment

Calculate the after-tax return on an investment with 12% pretax returns for an investor with a marginal tax rate of 35%.

Answer:

The after-tax return is calculated as follows:

$$r^* = r\,(1-T)$$

$$r^* = 0.12(1-0.35)$$

$$r^* = 0.078 = 7.8\%$$

Therefore, the after-tax return is 7.8%.

In some investments, investors may pay different tax rates depending on the return type. For example, interest or dividend income may be taxed as ordinary income while investment gains may be taxed at a different capital-gains rate. In this instance, income tax rates will be applied to relevant cash flows as in the following equation:

$$r^* = \left[w_{oi} \times r \times \left(1 - T_{oi}\right)\right] + \left[w_{cg} \times r \times \left(1 - T_{cg}\right)\right]$$

where:
r^* = after-tax return on investment
r = pretax return on investment
w_{oi} = portion of return subject to ordinary income tax rate
w_{cg} = portion of return subject to capital gains rate
T_{oi} = tax rate on ordinary income
T_{cg} = tax rate on capital gains

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Example: After-tax returns on investment where components are taxed at different rates.

An investment returns 10% annually. 70% of the returns are taxed as ordinary income at a 35% rate. The remaining 30% of returns are taxed as capital gains at 15%. What is the after-tax return of this investment?

Answer:

The after-tax return is calculated as follows:

$$r^* = \left[w_{oi} \times r \times (1 - T_{oi})\right] + \left[w_{cg} \times r \times (1 - T_{cg})\right]$$
$$r^* = \left[0.70 \times 0.10 \times (1 - 0.35)\right] + \left[0.30 \times 0.10 \times (1 - 0.15)\right]$$
$$r^* = 0.0455 + 0.0255$$
$$r^* = 0.071 = 7.1\%$$

Therefore, the after-tax return is 7.1%.

Tax-Deferral Wrappers

Tax-deferral allows investors to delay paying taxes on investment gains when they are accrued until the gains are paid to the investor. The advantage to investors is that their effective tax rate may be lower when the distribution is made compared to when the gains are earned. The after-tax rate on a tax-deferred investment is calculated using the following equation:

$$r^* = \left\{1 + \left[(1 + r)^N - 1\right](1 - T)\right\}^{\frac{1}{N}} - 1$$

where:
r^* = after-tax return on investment
r = pre-tax return on investment
N = number of years until distribution
T = tax rate

Example: Tax-deferred investments

An investor puts money into a tax-deferred investment for 15 years. The investor's tax rate is 35%. If the pre-tax return in the investment is 7%, what will be the after-tax rate on the investment?

Answer:

The after-tax return is calculated as follows:

$$r^* = \left\{1 + \left[(1+0.07)^{15} - 1\right](1-0.35)\right\}^{\frac{1}{15}} - 1$$
$$r^* = \{1 + [1.76](0.65)\}^{\frac{1}{15}} - 1$$
$$r^* = \{2.14\}^{\frac{1}{15}} - 1$$
$$r^* = 0.0521 = 5.2\%$$

Therefore, the after-tax return is 5.2%.

Tax Deferral and Tax Deduction Wrappers

A final wrapper combines a **tax deduction** on contributions with **tax deferral** on returns. The combination of the two tax effects can boost returns significantly, especially if one's tax rate at withdrawal is much lower than the tax rate at the time the contributions are made. The after-tax return on a product with both tax deferrals and tax deduction is calculated using the following equation:

$$r^* = \left[(1+r)^N \times \left(\frac{1-T_N}{1-T_0}\right)\right]^{\frac{1}{N}} - 1$$

where:
r^* = after-tax return
r = pre-tax return
N = years to withdrawal
T_N = tax rate at withdrawal
T_0 = tax rate at contribution

If the tax rate at withdrawal is the same as the tax rate at the time of contribution, the after-tax rate of return will equal the pre-tax rate of return. If the tax rate at withdrawal is less than the tax rate at the time of contribution, the after-tax rate of return will be greater than the pre-tax rate of return.

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Example: Tax deduction and deferral

An investor puts money into a tax-deferred, tax-deductible investment for 15 years. The investor's current tax rate is 35%. In 15 years, the investor's tax rate is expected to be 15% and the investor will withdraw the entire investment at that time. If the pre-tax return on the investment is 7%, what is the after-tax rate on the investment?

Answer:

$$r^* = \left[(1+0.07)^{15} \times \left(\frac{1-0.15}{1-0.35}\right)\right]^{\frac{1}{15}} - 1$$

$$r^* = [2.76 \times 1.31]^{\frac{1}{15}} - 1$$

$$r^* = 0.089 = 8.9\%$$

Therefore, the after-tax return is 8.9%.

Exotic Options

LO 28.3: Demonstrate knowledge of structured products with exotic option features.

For example:

- **Compare and contrast simple options and exotic options.**
- **Explain principal protected structured products.**
- **Define the participation rate.**
- **Illustrate how a cash-and-call strategy is related to put-call parity.**
- **Identify path-dependent options and binary options.**
- **Describe and apply barrier, knock-in, and active options.**
- **Describe the characteristics of in versus out and up versus down barrier options.**
- **Define spread options and look-back options.**
- **Define a quanto option.**

A **simple option** (also known as a *plain vanilla option*) has two characteristics:

- Value of option payoff is determined by the value of a single underlying asset on a single expiration date.
- The payoff increases linearly based on the difference between the strike price and the value of the underlying asset.

An **exotic option** is any option that has features that are not included in a simple option. As a result, exotic options have payoff diagrams that deviate substantially from simple options. Examples include:

- Payoffs prior to the option's expiration date.
- Payoffs that are non-linear.

Common exotic options include binary options, Asian options, barrier options, look-back options, spread options, and quanto options.

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Structured Product Features

A **principal-protected structured product** is an investment that is designed to have a minimum guaranteed payout, usually an amount equal to the investor's principal. It does not contain an exotic option (i.e., it is a simple option). Depending on its structure, the guarantee may be from a private source or a public source such as the U.S. Treasury or the Federal Deposit Insurance Corporation (FDIC). Depending on the type and source of the guarantee, there may be some risk that the guarantee is not met. This is referred to as counterparty risk.

The **participation rate** describes how much a product's payout increases as the value of the underlying asset changes. In 100% participation, if the underlying asset increases 25%, the payout also increases 25%. A 25% participation rate means that the payout rises 1% for every 4% increase in the value of the underlying asset. In situations where leverage is employed, the participation rate can be higher than 100%.

Relationship Between Cash-and-Call Strategy and Put-Call Parity

Put-call parity describes the relationship between call and put prices of the same asset, strike price and expiration month and the underlying asset. It only applies to European options and does not account for dividends, transaction fees, or changes in interest rates. At put-call parity, the value of the asset less its strike price is equal to the cost of the call option less the cost of the put option as shown below:

call price – put price = asset price – present value of strike price

Put-call parity can be used to create a principal-protected product. One strategy is to purchase the asset and to buy a protective put (i.e., at-the-money long put position is combined with the underlying stock). If the value of the asset declines, the put can be exercised to meet the principal guarantee. If the value of the asset rises, the put expires without being exercised.

A similar outcome can be achieved with a cash-and-call position. In a **cash-and-call strategy** (or *fiduciary call*), the investor owns a long position in cash or a zero-coupon bond and a long position in a call option. If the asset value rises, the investor can exercise the call option and meet the principal guarantee. If the asset value falls, downside protection comes from the cash or the zero-coupon bond at maturity.

Figure 1 illustrates how put-call parity requires that a protective put strategy has the same payoff as a cash-and-call strategy. Note that all simple option strategies have payouts that can be diagrammed with only two line segments.

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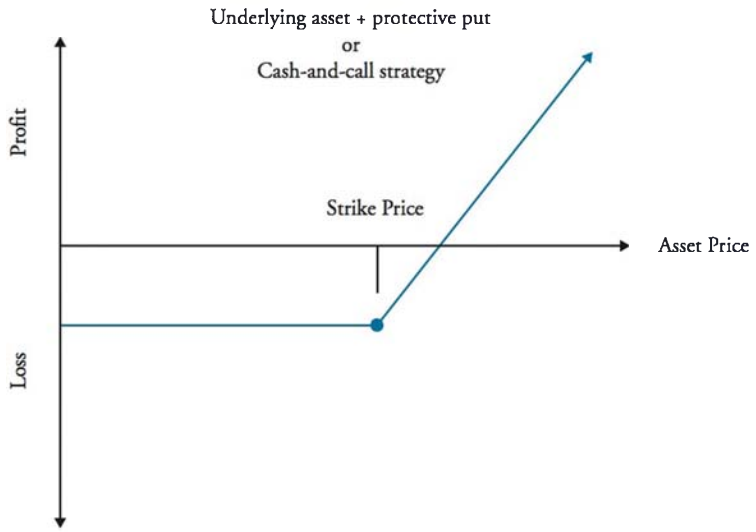
Figure 1: Equivalence of Two Investment Strategies



Asian Options

Asian options have payoff profiles based on the average price of the security over the life of the option. An Asian option is a considered a path-dependent option. A **path-dependent option** is valued based on the price of the underlying asset at points up to and including the expiration date. The price of a path-dependent option is based on both the underlying asset's price and the amount of time until expiration. The price of the option will change over time depending on these underlying factors. Other types of path-dependent options include binary options, barrier options, spread options, look-back options, and quanto options.

Binary Options

A **binary option** with a structured product has two outcomes depending on the price of the underlying asset relative to a specific threshold at expiration. If the asset is above the threshold, there is one payout. If it is below the threshold, there is a different (or no) payout. This type of non-linear payout is classified as a *discontinuous* payout, which differs from the continuous payout nature of simple options. Note that binary options for structured products are European options.

Barrier Options

A **barrier option** is an option with a range of payoffs (path dependent) such that a change in payoff occurs if the underlying asset reaches a specific level during a specific time. Barrier options in structured products have two components. The first is the barrier, or the price and time at which an underlying option is activated. The second is the strike price or terms of the underlying option. For each barrier and option combination, there are four possible outcomes, as shown in Figure 2.

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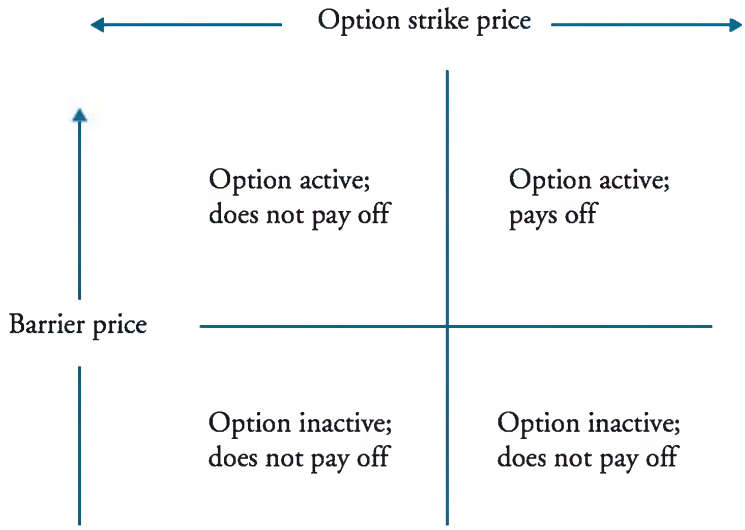
Figure 2: Barrier Options



Two types of barrier options are knock-in options and knock-out options.

A **knock-in option** is a barrier option that becomes effective if the underlying asset reaches a specific level at any point before expiration. Once the underlying asset reaches the trigger price, the knock-in option becomes an **active option**. If the underlying asset fails to meet the trigger price, the option never becomes active and expires worthless. However, just because a knock-in option is active, it does not necessarily mean that the underlying option will pay out. The underlying option will only pay out if its strike price and terms are met. A knock-in option can be either a put or call, depending on how the product is structured.

A **knock-out option** is the opposite of a knock-in option. In a knock-out option, the underlying put or call option terminates if the underlying asset reaches a particular price. If the underlying asset does not reach a specific price, the option stays active. As with a knock-in option, a knock-out option can be either a put or call, depending on how the product is structured.

While "in" or "out" refers to whether a barrier option becomes active (knock-in) or becomes inactive (knock-out), if the underlying reaches the barrier price, barrier options are further characterized as "up" or "down." Up and down refer to the direction the underlying asset price would have to go to reach the barrier price. Thus, a knock-in option can be "up and in" or "down and in," while a knock-out option can be "up and out" or "down and out." Figure 3 shows how knock-in and knock-out options are classified.

Figure 3: Barrier Options – In, Out, Up, and Down

	Underlier Below Barrier	*Underlier Above Barrier*
Knock-in Option	Up-and-in	Down-and-in
Knock-out Option	Up-and-out	Down-and-out

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Example: Barrier option

Consider a hypothetical structured product with knock-out put option. The barrier price is $100 for the underlying asset and the strike price on the put is $105. The underlying asset has moved from $110 to $85. **Identify** the type of barrier option described and **state** if it is active or inactive.

Answer:

This scenario describes a down-and-out put because the option becomes inactive (out) if the underlying asset price goes down to the barrier price. At $85, the underlying asset is below the barrier price of $100, so the put is inactive.

Spread Options

A **spread option** is a call or put option where the payoff is the difference between two prices or rates. The amount of the payoff will be higher if there is a large difference between the two prices. It will be smaller if the difference between the two prices is less.

Look-Back Options

A **look-back option** is similar to a spread option in that its payout is determined by the difference between two prices. In a look-back option, the payout is based on either the largest (look-back call option) or smallest (look-back put option) difference between the strike price and the underlying asset price, typically over the life of the option.

Quanto Options

A **quanto option** has a payoff in one currency using the underlying asset's value expressed in a different currency. For example, an investor owns a euro-based quanto call option on the Australian dollar-based S&P/ASX 200, a measure of the 200 largest index-eligible stocks listed on the Australian stock exchange. If the strike price on the S&P/ASX 200 is 5,500 and the index closes at 5,850 at the expiration date, the investor will receive €350.

Global Structured Products

LO 28.4: Demonstrate knowledge of examples of global structured products.

For example:

- **Discuss the example of a U.S.-based structured product with multiple kinks.**
- **Discuss the example of a France-based structured product with floors.**
- **Discuss the example of a German-based structured product with leverage.**
- **Discuss the example of a U.K.-based absolute return structured product.**
- **Discuss the example of a Swiss-based absolute return structured product.**
- **Discuss the example of a Japan-based structured product based on multiple currencies.**
- **Explain the advantages and disadvantages of liquid structured products.**

In this section, a brief review of the wide variety of structured products is conducted. While not comprehensive, it is intended to illustrate the diverse nature of the structured product universe.

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U.S.-based Structured Product with Multiple Kinks

In structured products, a **kink** refers to the point at which a payout changes from one rate to another rate. A structured product that has multiple different payouts is said to have multiple kinks.

For example, assume a structured product offered by a U.S. issuer has a life insurance annuity as a wrapper. The wrapper enables investors to earn tax-deferred returns. The product also allows investors to choose from a selection of underlying indices as a performance benchmark and an investment time horizon of one, three, or five years. Figure 4 shows payouts for a hypothetical structured product with multiple kinks based on the performance of an underlying index (r).

Figure 4: Payouts for Structured Product with Multiple Kinks

Underlier Performance	*Payout*
$-100\% < r \leq -15\%$	$r + 15\%$
$-15\% < r \leq 0\%$	0%
$0\% < r \leq 30\%$	r
$r > 30\%$	30%

Excluding fees, the product in Figure 4 has principal protection if the underlying index declines as much as 15% (i.e., if $r = -15\%$, than investor receives: $-15\% + 15\% = 0\%$). If the underlying index falls more than 15%, the investor will bear the principal losses less 15%. When a structured product offers some downside protection, it is referred to as a **partial floor**.

The structured product in Figure 4 also has a limit, or cap, on upside returns. If the underlying index increases more than 30%, the investor's return is limited to 30%.

Note that despite this product's complexity, it does not utilize exotic options and can be replicated using the following strategy:

product = underlying asset + bear put spread – out-of-the-money call

French-Based Structured Product with Floors

In structured products, a **floor** can also describe a minimum return used to calculate a payout. Consider a hypothetical structured product that is similar in structure to one created by a major bank in France. The product has a payout driven by the average gains and losses of seven different shares. The structured product has a floor of 20%. The product offers a one-year fixed coupon at a low rate and a minimum guaranteed return (floor) for shares with a positive return. At the end of the measurement period, any shares that return more than 0% but less than 20% are assumed to return 20% for the purposes of the payout calculation. While similar in structure to Asian options, this product does not use the multiple measurement dates required by Asian options.

Figure 5 shows the performance for each of the seven underlying shares. Performance for the underlying shares ranges from –30% to +60%, with the portfolio average coming in at 14.3%.

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Figure 5: Actual and Adjusted Performance for Underlying Shares in a Structured Product

Share	*Actual Performance*	*Adjusted Performance*
A	+10%	+20%
B	+25%	+25%
C	–30%	–30%
D	+15%	+20%
E	+60%	+60%
F	–20%	–20%
G	+40%	+40%
Average	14.3%	16.4%

At the end of the measurement period, the average performance of each of the shares is measured and the performance of those shares that return more than 0% but less than 20% is bumped to the floor of 20% (Shares A and D in this example). After the adjustment, the return increases from 14.3% to 16.4%.

This product can be replicated using the following strategy:

product = underlying portfolio + portfolio of bear spreads – portfolio of short binary puts

German-Based Structured Product with Leverage

In the past, structured products have been criticized in times of crisis due to the lack of a robust market. To address liquidity concerns, some German structured products have been created that use a certificate as a wrapper. Certificates offer investors low trading costs and liquidity because the issuers provide permanent bid and offer quotes.

A Sprint is one type of German structured product that offers upside leverage with liquidity. A Sprint consists of long position in an asset plus a long call option at a low strike price and a short call option at a high strike price, both on the same asset. The combination provides upside leverage when the underlying asset climbs above the strike price of the call option because investors get returns from both the appreciation of the underlying asset and the long call option. Upside is capped at a specific point by the short call option. The product offers the potential for high payouts within a predefined price range, but the gains are collared if the underlying continues to appreciate.

This product can be replicated using the following strategy:

product = underlying asset + bull spread

U.K.-based Absolute-Return Structured Product

An **absolute-return structured product** caters to investors interested in capturing volatility of returns. These products give payouts equal to the absolute value of the return on the underlying asset over a specified range of returns.

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For example, let's examine a hypothetical tax-free structured product that is structured similarly to a product that was issued in the United Kingdom. The payout on a hypothetical absolute-return product where the underlying asset fell 20% in value would be +20%. If the underlying asset rose 20%, the payout would also be +20%. Therefore, absolute-return structured product investors gain from large moves in underlying assets, or volatility, whether the movement is up or down. This type of payoff could be replicated with an at-the-money straddle.

One type of absolute-return structured product is a **principal-protected absolute return barrier note.** This type of product provides an absolute return payout as long as the underlying asset remains within a specified upper and lower barrier for a set time. If the underlying asset breaches either barrier, investors receive an amount equal to their principal as the payout.

This product can be replicated using the following strategy:

product = at-the-money up-and-out call + at-the-money down-and-out put

A Swiss-Based Structured Product Based on Absolute Returns

In the previous example, investors give up some upside returns in exchange for principal protection. Another form of absolute return product created by a Swiss bank eliminates or reduces principal protection in exchange for greater (or unlimited) upside returns. This product is beneficial in locations where tax rates for capital gains are lower than tax rates for income.

An example of an absolute-return structured product with some downside risk might include a downside barrier. The product pays an absolute return as long as the underlying asset does not decline more than the specific barrier (e.g., –20%). The product pays the actual return of the underlying asset if the value of the underlying asset reaches the lower barrier.

In this case, the investor gets absolute returns as long as the underlying asset trades within a range of 0% to –x% (the barrier). The investor can still participate in large gains. However, the investor is exposed to large losses if the underlying asset reaches the lower barrier.

This product can be replicated using the following strategy:

product = + at-the-money call + 2 at-the-money down-and-out puts – at-the-money put

A Japan-Based Structured Product Based on Multiple Currencies

Investors can also purchase structured products based on foreign exchange rates and different interest rates across different currencies. One example from Japan is a **power reverse dual-currency note (PRDC).** A PRDC investor makes a fixed interest rate payment in one currency in exchange for receiving a payment based on a fixed interest rate in different currency. The amount of the payment received changes as the exchange rate fluctuates and the amount of the payments is usually limited with caps and floors. Investors who believe that differing interest rates between two countries will not be reflected by changes in exchange rates are frequent purchasers of PRDCs.

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Liquid Structured Products

Investors in structured products often want to know that there is a robust market for these products so that they can buy or sell the securities when needed. **Liquid structured products** are listed and traded on major market exchanges. These products are considered liquid because there is always an active set of bids and offers for the products.

In order to be listed, a structured product must meet certain standards in terms of maturity, principal protection, and other measures. A disadvantage is that listed structured products may fail to meet an investor's particular needs. In exchange for this standardization, investors are able to accurately monitor the value of the structured product. In addition, standardization and listings make liquid structured products available to a larger investor pool. However, the popularity of liquid structured products has declined in recent years. This indicates that investors find that the products' disadvantages outweigh their advantages.

Pricing Structured Products

LO 28.5: Demonstrate knowledge of structured product pricing.

For example:
- **Identify the PDE approach to the pricing of structured products.**
- **Discuss the advantages of the simulation approach over the PDE approach.**
- **Contrast the PDE approach and the building blocks approach.**
- **Explain the two principles of payoff diagram shapes and levels.**
- **Discuss the evidence on structured product prices.**

The three primary methods for pricing structured products are the partial differential equation approach, the simulation approach, and the building blocks approach.

Partial Differential Equation Approach

Structured products are often valued using the **partial differential equation (PDE) approach**. The PDE approach assumes that the value of a structured product can be determined by analyzing and predicting the movement of the underlying asset and then formulating a hedge (riskless portfolio) based on the structured product and its underlying asset.

The calculation can be relatively straightforward in a situation where the underlying asset is riskless and interest rates are known and fixed.

1. Determine a formula that computes the change in the value of the riskless security over time.

2. Next, determine the required value of the underlying asset at a particular time given its boundary condition. The **boundary condition** refers to a relationship with regard to future asset values. This boundary condition can then be used to determine the present value of the asset. For example, if a riskless bond pays $1,000 at maturity, setting the maturity value of the bond at $1,000 is a boundary condition and would help us determine the present value of the bond.

3. Solve for the price of the structured product.

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In the real world with risky assets, the change in value of the underlying security is estimated by determining how two or more variables move in relationship to each other over time.

The PDE approach has three steps:

1. Determine the mathematical relationship between the movement of an option and the movement of its underlying asset.

2. Create a hedge (i.e., riskless portfolio) consisting of the structured product and its underlying asset.

3. Set the return for the riskless portfolio to r, determine the boundary condition, and solve for the value of the structured product.

The PDE approach can utilize both analytical and numerical methods. The Black-Scholes option pricing model is considered an **analytical method**. It starts with an equation that describes the mathematical relationship and then solves for the desired values.

Unfortunately, many structured products are too complex for analytical methods. These products require numerical methods. **Numerical methods** start with a set of discrete values and then use established mathematical models to try to describe the relationships between the underlying assets and variables.

Pricing with Simulation

Unfortunately, the analytical and numerical approaches can be unwieldy or impossible when valuing complex structured products. In these cases, investors often turn to Monte Carlo simulation. In **simulation,** investors create a large number of possible paths an underlying asset's value might take under differing conditions over time. These hypothetical paths are used to create an estimate for how the structured product would pay out under each situation. Finally, each of the options and potential payouts are averaged to get an estimate for the current price of the structured product. Simplicity is the key advantage of using simulation relative to the analytical and numerical approaches to estimating the value of a complex structured product.

Pricing with Building Blocks

The **building blocks approach** (or *portfolio approach*) breaks down a structured product into easy-to-analyze assets, estimates the value of each of the pieces, and then adds the results together to arrive at a value for the more complicated product.

The building blocks approach uses a static hedge (riskless portfolio) for each building block and its underlying asset. A **static hedge** means that the hedge does not need to be adjusted over time to maintain the needed risk level.

The building blocks approach is based on the concept that the value of a structured product at some point in the future equals the sum of the building blocks regardless of the values of the hedge components.

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The PDE approach is more complicated than the building blocks approach because the PDE approach uses dynamic hedging. In a **dynamic hedge**, the weights of the portfolio assets need to be constantly adjusted to maintain the desired risk exposure.

The downside to the building block approach is that to match a complex structured product, each of the building blocks needs to be available (meaning an appropriate substitute can be identified) and the block needs to trade at an efficient price.

Payoff Diagram Shapes and Levels

When investors look at payoff diagrams, they look at two aspects: (1) the shape and (2) the level.

- The **payoff diagram shape** shows risk exposure of the structured product compared to an underlying asset. Investors look at the shape to determine if the risk exposures meet their investment preferences.
- The **payoff diagram level** tells investors what return (percentage or amount) they can expect, relative to the price of the product. Investors look at the level to decide whether the product is attractively priced.

There are two principles to know about payoff diagram shapes:

1. Any payoff diagram shape can be constructed as long as there are adequate types and numbers of options with which to manage the risk exposure.

2. The level of the payoff diagram determines whether the product is priced appropriately.

Evidence on Structured Prices

Many investors use structured products as a way to get higher returns based on their particular market assumptions. **Overconfidence bias** is a tendency for investors to evaluate investment choices through a lens that reflects their particular market assumptions. Overconfidence bias may cause investors to downplay risk or overestimate returns on structured products that cater to the investor's market assumptions.

A key issue in complex structured products is whether the products are priced efficiently at the time of issue. Some studies suggest that structured products are often overpriced at issue. There is also evidence that total fees and expenses in some cases are lower than empirical studies suggest. In either case, one should be aware that it is very difficult to accurately value many structured products and that the more complex the product is, the more likely that it may be valued incorrectly.

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Motivation of Investors and Issuers

LO 28.6: Demonstrate knowledge of motivations of structured products.

For example:
- **Identify investor motivations for including structured products in a portfolio.**
- **Discuss tax-related motivations for investors.**
- **Discuss the motivations of issuers of structured products.**

Investor Motivations

Investors have eight motivations for investing in structured products:

1. Enhanced returns.
2. Enhanced liquidity.
3. Improved risk management.
4. Improved diversification.
5. Improved access to top managers.
6. Regulatory advantages.
7. Reduced income taxes.
8. Reduced transaction taxes.

Many investors look to structured products as a way to improve their after-tax returns, as seen in the last two motivations listed above. Two ways that structured products can be designed to provide tax benefits are:

- *Income tax efficiency:* Some structured products are designed so that payouts are recognized as capital gains instead of interest or dividends. This design benefits investors who pay lower taxes on capital gains than on ordinary income.
- *Transaction tax efficiency:* In jurisdictions with transaction taxes, structured products may be available that reduce them.

Issuer Motivations

Issuers of structured products can earn fee revenue and profits by creating products that are desired by investors. Other issuers create structured products to reduce their own cost of financing when pursuing preferable risk exposures or maturities.

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Key Concepts

LO 28.1

Equity-linked structured products are based on low risk assets guaranteeing a minimum level of return and then provide additional upside by tying returns to a risky asset. They differ from other structured product types that are based on pools of risky assets.

A wrapper is a legal contract between the issuer and investor that lays out specific terms of the equity-linked structured product. Wrappers usually have some benefit to investors such as reduced taxes or default protection.

Six types of wrappers are:

1. Over-the-counter (OTC) contracts.
2. Medium-term notes/certificates/warrants.
3. Funds.
4. Life insurance policies.
5. Structured deposits.
6. Islamic wrappers.

LO 28.2

In a tax-free investment, the after-tax return on wrappers equals the investment return.

In a fully taxed investment, the after-tax return on wrappers equals the investment return less applicable taxes.

In a tax-deferral investment, investors delay paying taxes on investment gains when they are accrued until the gains are paid to the investor.

In a tax-deferred and tax-deductible investment, investors are able to both delay paying taxes on investment gains and deduct their investment contributions for tax purposes.

LO 28.3

A simple option has two characteristics:

- Value of option payoff is determined by the value of an underlying asset on a single expiration date.
- The payoff increases linearly to the distance between the strike price and the value of the underlying asset.

An exotic option is any option that has features that are not included in a simple option (e.g., payoffs prior to expiration date and nonlinear payoffs).

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A principal-protected structured product is designed to have a minimum guaranteed payout, usually equal to the investor's principal.

The participation rate describes how much a product's payout increases as the value of the underlying asset changes.

In a cash-and-call strategy, the investor owns a long position in cash or a zero-coupon bond and a long call. Put-call parity requires that the payout of this position equals that of a protective put.

A path-dependent option is valued based on the price of the underlying asset at points up to and including the expiration date. Five key types of path-dependent options are:

- Binary option: has two outcomes depending on the price of the underlying asset relative to a specific threshold at expiration.
- Barrier option: has a range of payoffs and a change in payoff if the underlying asset reaches a specific level during a specific time period. When this occurs, the option becomes an active option. For each barrier and option type, there are four potential combinations as seen below:

	Underlier Below Barrier	*Underlier Above Barrier*
Knock-in Option	Up-and-in	Down-and-in
Knock-out Option	Up-and-out	Down-and-out

- Spread option: payoff is the difference between two prices.
- Look-back option: payoff is based on either the largest or the smallest difference between the two reference prices over the life of the option.
- Quanto option: has a payoff in one currency using the numerical value of the underlying asset expressed in a different currency.

LO 28.4

Examples of global structured products include:

- U.S.-based structured product with multiple kinks = underlying asset + bear put spread – out-of-the-money call
- French-based structured product with floors = underlying portfolio + portfolio of bear spreads + portfolio of short binary puts
- German-based structured product with leverage = underlying asset + bull spread
- U.K.-based absolute-return structured product = at-the-money up-and-out call + at-the-money down-and-out put
- Swiss-based structured product based on absolute returns = at-the-money call + 2 at-the-money down-and-out puts – at-the-money put
- Japan-based structured product based on multiple currencies: Investor makes a fixed interest rate payment in one currency in exchange for receiving a payment based on a fixed interest rate in different currency. Payment amount is usually limited with caps and floors.

Liquid structured products are listed on major market exchanges. A disadvantage is that listed structured products may fail to meet an investor's particular needs due to the products' standardized nature. However, these products offer investors better monitoring and improved access.

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LO 28.5

Methods for pricing structured products include:

- Partial differential equation (PDE) approach: assumes the value of a structured product can be determined by analyzing and predicting the movement of the underlying asset and then formulating a hedge based on the structured product and its underlying asset; uses dynamic hedging.
- Simulation approach: hypothetical paths for the underlying asset's value are used to create an estimate for how the structured product would pay out under each situation.
- Building blocks approach: breaks down a structured product into easier to analyze assets, estimates the value of each of the pieces, and then sums the values to determine the total value of product; uses static hedging.

Two principles to know about payoff diagrams:

- Any payoff diagram shape can be constructed as long as there are adequate types and numbers of options with which to manage the risk exposure.
- The level of the payoff diagram determines whether the product is priced appropriately.

Some studies suggest that structured products are often overpriced at issue. There is also evidence that total fees and expenses in some cases are lower than empirical studies suggest.

LO 28.6

Eight motivations for investing in structured products:

- Enhanced returns.
- Enhanced liquidity.
- Improved risk management.
- Improved diversification.
- Improved access to top managers.
- Regulatory advantages.
- Reduced income taxes.
- Reduced transaction taxes.

Motivations for issuing structured products:

- Fee revenue and profitability.
- Beneficial source of financing (i.e., lower financing costs, superior risk exposures, desirable maturities).

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Concept Checkers

1. What type of structured product wrapper is *most likely* to feature tax deferral?
   A. Islamic wrapper.
   B. Life insurance wrapper.
   C. Certificate of deposit (CD) wrapper.
   D. Quanto wrapper.

2. An investment returns 7% annually. 80% of the returns are taxed as ordinary income at a 38% rate and the remaining 20% of returns are taxed as capital gains at 15%. The after-tax return of this investment is *closest* to:
   A. 2.3%.
   B. 3.5%.
   C. 4.7%.
   D. 5.6%.

3. If an investment with a 25% participation rate appreciates 50%, the investor's return is *closest* to:
   A. 12.5%.
   B. 25%.
   C. 50%.
   D. 75%.

4. An option which becomes inactive if the underlying asset price increases above the barrier is *best* described as which of the following?
   A. Up-and-in.
   B. Down-and-in.
   C. Down-and-out.
   D. Up-and-out.

5. Which of the following options structures *most closely* mimics a German structured product with leverage?
   A. Product = underlying asset + bear put spread – out-of-the-money call.
   B. Product = underlying asset + bull spread.
   C. Product = underlying portfolio + portfolio of bear spreads.
   D. Product = underlying asset + bull put spread – out-of-the-money call.

6. Consider a hypothetical structured product with a payout driven by the average gains and losses of four different shares. The structured product has a floor of 20% for any shares posting a positive return. At the end of the measurement period, the shares perform as follows: +10%, +25%, +5%, –5%. The return to the investor is *closest* to:
   A. 8.75%.
   B. 15.0%.
   C. 16.25%.
   D. 21.67%.

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7. If an investor estimates the price of a structured product by averaging a large number of possible paths and an underlying asset's value might take under differing conditions over time, which pricing approach are they *most likely* using?
   A. Analytical approach.
   B. Building blocks approach.
   C. Numerical approach.
   D. Simulation approach.

8. Which of the following is *least likely* a motivation for an investor to buy a structured product?
   A. Income tax efficiency.
   B. Diversification.
   C. Lower cost of financing.
   D. Transaction tax efficiency.

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Concept Checker Answers

1. **B** Tax deferral is a frequent benefit of life insurance wrapper. Investors choose an Islamic wrapper because it complies with shari'a law. A CD wrapper is frequently chosen for principal protection. A quanto is not a wrapper type, but rather is a type of option. (LO 28.1)

2. **C** Given the pretax return of 7%, 80% of cash flow taxed as ordinary income at 38% and 20% taxed as capital gains, the after-tax return is:

   $r^* = [0.80 \times 0.07 \times (1 - 0.38)] + [0.20 \times 0.07 \times (1 - 0.15)]$

   $r^* = 0.0347 + 0.0119$

   $r^* = 0.0466$

   The after-tax return is closest to 4.7% (LO 28.2)

3. **A** The investor's return is the participation rate multiplied by the increase in the investment. The investor's rate of return is: 25% × 50% = 12.5%. (LO 28.3)

4. **D** A barrier option that becomes inactive (out) if the underlying asset price increases above the barrier (up) is an up-and-out option. (LO 28.3)

5. **B** The German-based structured product with leverage can be replicated with a portfolio containing a long position in the underlying asset and a bull spread. (LO 28.4)

6. **B** To calculate the investor return, raise the return on any stock with a return greater than 0% and less than 20% to 20%, and then average the performances together. (LO 28.4)

Share	*Actual Performance*	*Adjusted Performance*
A	+10%	+20%
B	+25%	+25%
C	+5%	+20%
D	–5%	–5%
Average	8.75%	15%

7. **D** The simulation approach involves the creation of multiple hypothetical paths for product payouts. (LO 28.5)

8. **C** Issuers, not investors, may experience a lower cost of financing assets via a structured product. Income tax efficiency, diversification, and transaction tax efficiency are all motivations for investors to buy structured products. (LO 28.6)

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The following is a review of the Risk Management and Portfolio Management principles designed to address the learning objectives set forth by the CAIA Association®.

Cases in Tail Events

Topic 7.1

Exam Focus

This topic review presents several examples of recent hedge fund collapses. You need to have an understanding of the specific hedge fund strategies employed by these funds and the factors that contributed to their demise. Know how managers use leverage to increase return on assets, and the risks associated with high levels of leverage. Understand how behavioral biases contributed to the collapses of some of these funds. You should be familiar with the impact that new trading technologies have had on financial crises, and be knowledgeable of recent fund failures that were due to fraud. Finally, be able to identify the broad conclusions that can be drawn from hedge fund failures.

Hedge Fund Collapses Due to Market Losses

LO 29.1: Demonstrate knowledge of the effect of market forces in generating hedge fund losses.

For example:

- **Discuss the collapse of Amaranth Advisors, LLC; the due diligence issues related to it; and lessons learned from the case.**
- **Discuss the collapse of Long-Term Capital Management (LTCM), the due diligence issues related to it, and lessons learned from the case.**
- **Discuss the collapse of Carlyle Capital Corporation, the due diligence issues related to it, and lessons learned from the case.**
- **Discuss the link between declining investment opportunities and use of leverage.**
- **Apply the concepts of return on equity, return on assets, and leverage to evaluate levered investment situations.**
- **Identify and describe behavioral biases and their potential effects on risk taking.**

Note that the following examples of hedge fund failures had multiple issues beyond simple market losses that led to their demise. However, market losses were the catalyst to their failure and exposed the weaknesses of the funds' investment strategies.

Amaranth Hedge Fund

Amaranth Advisors, LLC was a multistrategy hedge fund based in Greenwich, Connecticut. The fund was started in 2000 by convertible arbitrage trader Nicholas Maounis. In 2004, Amaranth hired Brian Hunter, a Canadian gas trader, to head up an energy trading team located in Calgary, Canada that included a group of former Enron energy traders.

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To understand Hunter's trading strategy, a quick background on the natural gas market is needed. The primary demand for natural gas is for heating during the winter months. From the spring through fall, demand for natural gas is low, so the surplus is injected and stored in the ground. Hunter made directional bets on the price of natural gas by going long futures for winter contracts and short futures for nonwinter contracts (i.e., a calendar spread strategy).

At first, Hunter and his team were quite successful in terms of returns. However, most of Amaranth's risk was allocated to Hunter's energy group. Although the fund was marketed as a multistrategy fund, it increasingly became a focused energy fund that placed directional bets on natural gas prices.

Hunter made huge directional bets on the prices of energy products. Due to his anticipation of an increase in natural gas prices and the arrival of Hurricane Katrina to the U.S. gulf coast, Hunter's group earned the fund $1.3 billion in 2005, which netted Hunter a $75 million bonus. By 2006, energy trades accounted for half of Amaranth's capital and an increasing level of both profits and volatility.

By 2006, Amaranth's strategy started to become unstable. At this point, energy trades accounted for 75% of Amaranth's profits and 50% of Amaranth's capital. In addition, its open positions in natural gas often accounted for a majority of open positions for a particular month. In May, the group lost $1 billion due to natural gas spread compression (Amaranth had bet natural gas spreads would widen). Traders in other areas had to unwind positions to raise capital to support the losses in the energy group. However, Hunter's group was allowed to maintain its huge positions, hoping to recover losses. Energy positions eventually moved in Amaranth's favor and by August, it had achieved a new high for assets under management (AUM) of $9.2 billion. Investors and managers of the fund had no idea that the fund would move from its high watermark to collapse in less than two months.

The end for Amaranth occurred August 29, 2006, when its energy positions lost hundreds of millions in the last half hour of trading. At the start of September 2006, Amaranth remained long March 2007 contracts and short April 2007 contracts. Amaranth remained confident that the spread was going to widen, which would lead to considerable profits from the strategy. The spread, however, contracted and resulted in massive losses. By the close of business on Friday, September 15, Amaranth faced losses of $2 billion. The company spent the weekend desperately trying to find a buyer for its energy portfolio, but the number and size of the energy positions combined with the deal's contingencies and short review period made potential buyers, such as Goldman Sachs and Warren Buffet, unwilling to pay Amaranth's asking price. Amaranth was eventually able to sell 25% of its natural gas portfolio to Merrill Lynch for $250 million. However, its remaining energy portfolio suffered an additional $800 million in losses by the end of trading on the following Tuesday. As a result, Amaranth was forced to sell its energy positions to its prime broker, JPMorgan, and to a hedge fund, Citadel, for a discount of more than $2 billion and liquidate its remaining holdings. In sum, Amaranth lost more than $6 billion in a few months.

Lessons from Amaranth

Lessons learned from the collapse of Amaranth include:

- *Prime brokers can have a significant impact on the viability of a hedge fund.* JP Morgan blocked Goldman Sachs' rescue of Amaranth by not releasing collateral deposited by Amaranth.

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- *Multistrategy funds should be diversified.* Fund managers often choose to deviate from their stated style in response to market conditions or portfolio conditions. However, style drift is of particular concern to an investor, as the fund's risk exposures will change and likely no longer align with the rest of the investor's portfolio. A multistrategy fund, such as Amaranth that has 50% of its portfolio committed to the natural gas market, would not be considered diversified. Investors should have confronted the firm about the style drift, even if exiting the fund was not an option due to the strict lockup provisions.
- *Fund managers should carefully monitor all of the fund's traders regardless of the size of their profits or past track record.* Fund managers should have been especially vigilant regarding actions taken by Hunter due to his team being geographically separated from the fund manager and the fact that Hunter had lost his trading privileges at a previous employer, Deutsche Bank, due to large trading losses.
- *Amaranth operated in largely unregulated arenas.* Because it is a hedge fund, it was not unusual that on some level Amaranth was unregulated. However, the firm went to extremes, such as moving its natural gas trading off the regulated New York Mercantile Exchange (NYMEX) to the Intercontinental Exchange (ICE), in order to continue holding excessive positions.
- *Improper risk management was key to Amaranth's downfall, as Amaranth did not have sufficient risk controls in place to prevent its ultimate downfall.* The strategy used significant leverage, had a nearly $4 billion VaR in September 2006, and involved high levels of market and liquidity risk. Despite this, Amaranth failed to consider the potential for increased future volatility and did not implement stop-loss or concentration limits.
- *The futures market for commodities is small enough that one fund can consume the majority of contracts.* Amaranth's positions were so significant that they were driving the market. Some firms started taking positions opposite Amaranth because they knew prices were being driven by large-scale trading and not by the supply and demand of the underlying asset.

Professor's Note: It is difficult to grasp the scale of the trading by Amaranth. As an example, Amaranth's January 2007 position in natural gas futures represented all of the gas used by residential customers in January. They controlled significant portions of the outstanding natural gas futures contracts on the NYMEX for delivery in 2006–2010, ranging from 25–48% of contracts for 2006 delivery up to around 60% of contracts for 2010 delivery.

Long-Term Capital Management

Long-Term Capital Management (LTCM) was a hedge fund based in Greenwich, Connecticut that collapsed in 1998. This collapse came as a surprise to most and threw the global financial markets into a panic, because until that point, LTCM had been seen as one of the most competently managed hedge funds in existence. (In fact, two Nobel laureates in economics sat on the board of directors.) Between May 1998 and September 1998, the value of LTCM's assets plunged from $5 billion to $0.4 billion.

LTCM primarily focused on relative value strategies, with fixed-income arbitrage in particular. The strategy behind LTCM's trades was to identify two similar securities that were trading at different spreads. LTCM would buy the relatively less expensive security, short the more expensive security, and then wait for the spreads and prices to converge, leading to a profit.

Fixed-income arbitrage is not generally a dangerous strategy, though the potential profits are typically small. However, because LTCM had great confidence in its trade ideas, the firm applied increasing amounts of leverage to its positions, eventually reaching a level of 50 to 1. On top of this, LTCM layered futures contracts, swaps, and other derivative positions, bringing real leverage to nearly 300 to 1.

In August of 1998, the Russian government defaulted on its bonds. This default led to sudden changes in the financial markets, including widening spreads and a lack of liquidity. For LTCM, this led to large losses and a resulting margin call from LTCM's prime broker. When LTCM found itself unable to meet this margin call, it was forced to begin to liquidate its positions into an increasingly illiquid market. This set LTCM into a downward spiral of additional margin calls and further liquidations.

Concerns about the impact that a failure of LTCM might have on the overall financial market led to a rescue by a consortium of 14 brokerage firms and banks. These entities stepped in with a $3.6 billion capital infusion in exchange for a 90% share of the fund.

Related Due Diligence Issues

In the aftermath of LTCM's bailout, questions emerged about why LTCM's counterparties had allowed the fund to increase leverage to such extreme levels. The conclusion was that these counterparties were not aware of (and did not demand information about) the total value of LTCM's positions. Without the awareness of its creditors, LTCM was able to take on extremely large positions and was granted enormous amounts of credit.

Lessons From LTCM

It is important to note that it was neither a faulty investing strategy nor unsuitable trades that led to LTCM's crisis. In fact, LTCM's spread trades would have been profitable over time had the fund not been forced to liquidate its positions. Russia's default led to a flight to quality and a divergence (rather than convergence) of LTCM's relative value positions. The flaw that led to LTCM's downfall was the fund's extreme levels of leverage, which left the fund susceptible to a liquidity crisis.

Lessons learned from LTCM include:

- *Leverage can turn a relatively low-risk strategy into a high-risk strategy.* While LTCM's basic approach to investing was well founded, the firm did not take into account the challenges that large amounts of leverage would cause under unusual market conditions.
- *Market participants should be aware of counterparty leverage:* LTCM's creditors were unaware of the extent to which their counterparty risk exposure was increasing as LTCM leveraged up. LTCM's creditors should have demanded information about the firm's balance sheet before extending more credit.
- *During extreme market events, liquidity will disappear.* Because of the amount of leverage that LTCM had taken on, the firm was unable to survive a liquidity crisis.

Carlyle Capital Corporation (CCC) Hedge Fund

The Carlyle Group, a well-known alternative investment firm that manages over $100 billion in assets, established **Carlyle Capital Corporation** (CCC) in 2007. CCC was a hedge fund that was publicly traded on the Amsterdam stock exchange with the Carlyle Group retaining a 15% ownership stake. CCC's investment strategy was to borrow capital at short-term rates and purchase long-term AAA-rated mortgage bonds.

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CCC purchased bonds issued through Freddie Mac and Fannie Mae with the expectation that these bonds were low risk. This expectation of low risk was because Freddie Mac and Fannie Mae are U.S. government-sponsored entities and it was implied that the U.S. government would guarantee any bonds they issued. To increase returns, the fund employed leverage of about 32 times. This leverage meant that CCC was able to hold nearly $22 billion in mortgage securities with less than $700 million of equity. Of course, this high level of leverage meant that a portfolio decline of more than 3% would result in the $700 equity value being completely erased.

In early 2008, the AAA-rated mortgage bonds lost significant value and CCC's lenders began to seize the majority of the fund's collateral. The fund ended up defaulting on its loans in March because it had become insolvent. The time between its initial public exchange listing in July 2007 and collapse in March 2008 was a mere eight months. While the company's share price was $20 at launch, equity investors lost their entire investment by mid-March.

Lessons from CCC

Lessons learned from the CCC collapse include:

- Mortgage securities that are backed by the faith of the U.S. government (either implicitly or explicitly) are not free from the risks of credit and liquidity crises.
- Hedge funds cannot rely on creditors to modify terms or prime brokers to extend liquidity during periods of distress.
- High levels of leverage, even if used with low-risk securities, can still have disastrous consequences.

Declining Investment Opportunities and Leverage

When investment returns begin to shrink due to strategy degradation, naïve fund managers attempt to maintain past return levels by ratcheting up the amount of leverage utilized by the fund. However, this increased leverage can result in catastrophic losses or fund liquidation if the market moves even slightly from the manager's forecast. Investors should evaluate not only a fund's total return but also the level of leverage used to achieve this return.

To further demonstrate this concept, we next look at the relationship among **return on equity** (ROE) (i.e., return on investor's capital), **return on assets** (ROA) (i.e., return on total portfolio assets), and **leverage** (L) (i.e., ratio of portfolio assets to investor equity). The relationship can be stated mathematically as follows:

$$ROE = (ROA \times L) - [r \times (L - 1)]$$

where:
ROE = return on equity
ROA = return on assets
L = leverage
r = interest rate paid on leverage

Using this equation, we can determine the required ROE, ROA, or leverage, if we are given the other two values. This is demonstrated in the following examples.

Example: ROE calculation

A hedge fund relies on a 3-to-1 leverage ratio to enhance the returns of its investment strategy. The strategy is forecasted to earn a 7% return on assets in the next year. In addition, the fund will pay 2% interest on any debt borrowed to leverage its returns. **Calculate** the fund's expected ROE.

Answer:

Using the ROE formula, we determine the fund's expected ROE as follows:

$$ROE = (ROA \times L) - [r \times (L - 1)]$$

$$ROE = (0.07 \times 3.0) - [0.02 \times (3.0 - 1)]$$

$$ROE = 0.17 = 17\%$$

Example: Leverage calculation

A hedge fund relies on leverage to enhance the returns of its investment strategy. The strategy is forecasted to earn a 6% return on assets in the next year. In addition, the fund will pay 1% interest on any debt borrowed to leverage its returns. If the fund manager's goal is to earn a 23% return on its equity next year, **calculate** the required leverage ratio that will be needed to achieve this return.

Answer:

Using the ROE formula, we determine the required leverage as follows:

$$ROE = (ROA \times L) - [r \times (L - 1)]$$

$$0.23 = (0.06 \times L) - [0.01 \times (L - 1)]$$

$$0.22 = (0.05 \times L)$$

$$L = 4.4$$

Intuitively, this result of a 4.4 leverage ratio makes sense, as we can easily estimate that a leverage ratio of almost 4.0 is needed to achieve the return before factoring in the interest cost of leverage.

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Example: ROA calculation

A hedge fund relies on a 7-to-1 leverage ratio to enhance the returns of its investment strategy. The fund manager's targeted return on equity is 16%. In addition, the fund will pay 2% interest on any debt borrowed to leverage its returns. **Calculate** the fund's required return on assets.

Answer:

Using the ROE formula, we determine the fund's expected ROA as follows:

$$ROE = (ROA \times L) - [r \times (L - 1)]$$

$$0.16 = (ROA \times 7) - [0.02 \times (7 - 1)]$$

$$0.16 = (ROA \times 7) - [0.12]$$

$$ROA = 0.04 = 4\%$$

Behavioral Biases

Behavioral biases include cognitive, emotional, and social biases that cause people to act in an irrational manner. **Behavioral finance** examines how behavioral biases impact financial markets. For example, behavioral biases may explain why the fund managers involved in the previously mentioned fund collapses failed to realize the actual risk of their investment strategies. Two common behavioral biases are confirmation bias and anchoring.

- **Confirmation bias** refers to instances where individuals more heavily weigh information that agrees with their beliefs while discounting information that disagrees with their beliefs.
- **Anchoring** refers to the fact that individuals seem to be anchored to a value or belief as if it has a gravitational pull. Anchoring can cause fund managers to be overly confident that markets or strategies that have earned them profits in the past will continue to earn profits in the future. Of course, these managers may be failing to account for the fact that the investment environment has likely changed.

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Impact of Trading Technologies in Financial Crises

LO 29.2: Demonstrate knowledge of the impact of trading technologies in financial crises.

For example:
- **Discuss how the unwind hypothesis and crowded trades explain the Quant Meltdown of August 2007.**
- **Discuss how a circuit breaker can help prevent a flash crash.**
- **Discuss how technical issues at one large market participant can impact the financial markets.**

Over the past several decades, the processing of financial market transactions has evolved from manual pencil-and-paper and verbal processes to highly automated, computer-based trading. While these technological improvements have greatly increased efficiency, these advances have also increased potential systemic risk, as the examples below illustrate.

Quant Meltdown of August 2007

As the U.S. subprime mortgage crisis began to take hold in early-to-mid 2007, many quantitative long/short (market neutral) equity hedge funds began to experience significant losses. These losses led funds to begin to unwind their investment positions in the second half of 2007 in order to decrease leverage and generate cash. This unwinding caused corresponding securities prices to move in response, causing additional losses for other funds that had taken similar long/short positions but were slower to unwind. This chain of events quickly turned into a spiral of unwinding. From August 6–9, many successful hedge funds suffered record losses. The main losers were hedge funds that employed statistical arbitrage and equity-market-neutral strategies. Interestingly, as many long-established hedge funds were suffering enormous losses, the initial impact on equity markets was relatively small.

Shortly afterward this meltdown, MIT researchers Amir E. Khandani and Andrew W. Lo tried to explain these losses among quantitative equity-market-neutral hedge funds using an **unwind hypothesis**, which asserted that the returns are likely attributable to the initial liquidation of one or several major hedge funds. Khandani and Lo suggested that many of these funds had used similar strategies and taken similar positions, creating a **crowded trade** situation. A crowded trade represents an additional source of risk for investors, since it creates the possibility that these market participants will try to exit their similar positions by buying or selling the same security at the same time. This risk is amplified by the rapid trading that new technologies have made possible.

Flash Crashes and Circuit Breakers

The 2010 Flash Crash happened on the afternoon of May 6, 2010. Throughout the day, U.S. equity markets had drifted downwards by approximately 3% due to various concerns about the global economy, including a debt crisis that was taking place in Greece. Then, unexpectedly at 2:42 pm, equity prices began to plunge, losing an additional 6% within five minutes, bringing the total loss for the day to more than 9%. At 2:47 pm, the market reversed and within 20 minutes had rallied back by 6%, to finish the day at nearly the same level at which the flash crash began. This crash represented the second-largest price swing that the markets had ever experienced.

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Initially, fingers were pointed in many directions, including technical issues, high-frequency trading, and trading errors. In the final analysis, the U.S. Department of Justice concluded that a British trader had caused the crash by using spoofing algorithms to place an order to sell $4.1 billion worth of E-mini S&P 500 stock index futures contracts—into a market that was already thin and volatile. **Spoofing** refers to attempts by traders to influence market prices by entering large orders with no expectation of executing the orders. As these orders began to impact the futures markets, other traders rapidly joined in to sell futures contracts. Within minutes, arbitrageurs began selling equities in the spot market, pushing the spot market down.

Mechanisms and procedures called **circuit breakers** exist to mitigate this kind of sudden crash and their usage was expanded after this crash. Generally, these circuit breakers act by restricting trading in the event of significant market fluctuations, under the premise that the pause will allow market participants time to gather information and make informed trading decisions. However, the effectiveness of circuit breakers is arguable. Some experts believe that this mechanism actually heightens risks related to illiquidity.

Technical Issues' Impact on Financial Markets

At the end of 2011, **Knight Capital Group** was the largest U.S. equities trader, representing about 17% of trading volume. The company offered a range of trading services to various large clients such as investment banks and brokerage firms.

On August 1, 2012, Knight installed an untested and (it later turned out) defective piece of software that caused Knight's trading systems to enter millions of erroneous orders. This software caused a small loss to accumulate with each trade. By the end of the day, those losses had totaled $460 million. By August 3, it was apparent that Knight was in deep trouble as customers were fleeing, and the company's value had plunged by almost 75%.

After analyzing the losses, the SEC placed the blame on two areas: (1) mistakes related to technology, and (2) employees' failure to act on automated email messages that indicated a potential problem prior to the open of the market on August 1. Knight was subsequently fined $12 million by the SEC for violating trading rules enacted in 2010 that required market participants to put controls in place that would isolate the markets from this type of trading error.

Because even a small trading error is magnified by the speed of transactions, continued advances in electronic trading make it inevitable that technical errors will continue to impact financial markets in the future.

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Hedge Fund Collapses Due to Fraud

LO 29.3: Demonstrate knowledge of major fund failures caused by fraud.

For example:

- **Discuss the case of Bayou Management, the due diligence issues related to it, and lessons learned from it.**
- **Discuss the case of Bernie Madoff, the due diligence issues related to it, and lessons learned from it.**
- **Discuss the case of Lancer Group, the due diligence issues related to it, and lessons learned from it.**

While the previous examples were largely driven by market conditions, trading technologies, and inadequate risk protection, the next three examples of fund collapses were the result of fraudulent activities by fund managers and employees. **Fraud** involves deliberate deception to secure an unlawful gain.

Bayou Hedge Fund Fraud

The **Bayou Fund** started in 1996 as a legitimate hedge fund founded by Samuel Israel III and Daniel Marino. After it sustained losses just a few months after inception, the fund quickly turned into a fraud by fabricating its financial statements to hide its losses and high volatility. In 1997, the principals established a broker, Bayou Securities, to process the fund's trades. Bayou Securities received commissions from the Bayou Fund and rebated the commissions to conceal the losses. While using a wholly owned broker is not illegal, the fact that Bayou's principals earned transaction fees gave them an incentive to trade more frequently than necessary to earn fees (i.e., engage in churning) and use this broker to trade even if other brokers charge lower fees or provide better trade execution. In addition, Bayou never revealed this arrangement to its investors. Instead, it led investors to believe that its profits were the result of its trading strategy.

By 1998, Bayou was losing millions of dollars annually. In order to keep its losses secret, the Bayou managers fired their independent auditors and created an accounting firm by the name of Richmond-Fairfield Associates. The newly created accounting firm created fictitious audit documents verifying the falsified financial statements.

Through 2002, the fund continued to operate and falsify records that indicated the fund was earning average monthly returns of 1–2%. In 2003, Bayou lost $49 million but Bayou Securities made approximately $29 million in commissions. In 2003, Bayou decided to solicit additional investor capital by liquidating the Bayou Fund and creating four new hedge funds: (1) Bayou Accredited, (2) Bayou Affiliates, (3) Bayou No Leverage, and (4) Bayou Superfund. Unfortunately, these new funds also incurred large losses that were covered up. For example, one of the funds, Bayou Superfund, contained $90 million of investor capital and claimed a profit of $25 million in 2003. However, in reality, Bayou Superfund lost $35 million that year.

During 2004, Bayou funds ceased all trading and the funds' assets were transferred to Israel. The state of Arizona stumbled onto the fraud in 2005 while investigating an unrelated money laundering case. The Arizona investigators discovered large sums of money being transferred overseas. The details of the crime were documented in a suicide note by written by Marino, although he never committed suicide. Eventually, the investigators were able

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to recover $100 million of investors' capital. Continuing the story in 2008, Israel faked his own suicide one day before he was to begin his prison sentence but later surrendered to authorities.

Lessons from Bayou

Lessons learned from the Bayou fraud include:

- *Investors should conduct background checks on the principals of a fund.* Had investors done proper due diligence regarding the founders' histories, they would have found out that Israel lied about both the length of time and the level of job he held with a prior fund. These facts would likely have been discovered by investors through a few simple phone calls.
- *Investors should demand hedge funds use a well-known, independent auditor.* The sham auditing firm, Richmond-Fairfield Associates, created by Bayou, was left unexamined by investors, despite the fact that no one had ever heard of them. The firm also wired money out of the Bayou funds and into unreported bank accounts at Citibank and Wachovia. A large transfer to Wachovia finally raised red flags at the bank and ultimately led to the fall of Bayou.
- *Investors should realize that regulations are not a suitable substitute for due diligence.* Despite violating numerous regulations and laws, Bayou's managers managed to evade detection form regulators for over eight years. In addition, the Bayou fraud was only discovered by accident, not because investors or regulators had become suspicious of Bayou's actions.

Bernie Madoff Ponzi Scheme

Bernie Madoff ran a securities firm that had over 200 employees and was one of the largest market makers on the NYSE. He is now serving a 150-year prison sentence for operating a Ponzi scheme. Madoff promised investors steady returns with low volatility. As a result, feeder funds (i.e., funds that pooled money and invested with Madoff) allocated money to Madoff and the strategy was marketed worldwide. Madoff reported uncommonly stable returns that rose steadily throughout multiple market cycles. The performance, however, was not generated from legitimate investment returns. While Madoff may have actually traded securities for his clients in the early years, for the last many years, he simply took in investor capital, created fictitious financial reports indicating impressive results, and fulfilled redemption requests from old investors using capital collected from new investors.

Along the way, the credibility of Madoff's fund and results were called into question several times by Harry Markopolos, who worked for a competing firm. Madoff claimed to have used an option collars to generate returns. An **option collar** is constructed by purchasing an equity position, selling a call, and buying a put option with a strike price less than that of the call. These positions effectively put a band or collar around the possible returns. Both the upside and downside are limited, the downside by the long put and the upside by the short call. Due to its limited upside, Madoff's use of this common strategy to generate large average returns should have raised suspicions among both investors and firm employees.

Markopolos created simulated results of the strategy showing that Madoff's records were not valid and turned his evidence over to the Securities and Exchange Commission (SEC) in 2000 and 2001. In 2005, Markopolos again approached the SEC and even claimed that Madoff was running a Ponzi scheme. The term **Ponzi scheme** refers to the fact that early investors were paid returns by using funds collected from newer investors. In 2006 and

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2007, Markopolos again tried alerting the SEC of Madoff's potential fraud. The SEC's investigations of Madoff failed to reveal anything.

This fraud may have gone on for longer, but Madoff's sons turned him in to authorities during December 2008 after he told them that his investment management business was a Ponzi scheme. Madoff was ultimately arrested and confessed to the fraud. The cost of the fraud is estimated at $50 billion. Fund investors who experienced losses are seeking **restitution** (i.e., financial compensation for their investment losses) from both Madoff and fund investors that earned profits from the fraud.

Lessons from Madoff

Lessons learned from Madoff's fraud include:

- *Investors should be aware of affinity fraud.* **Affinity fraud** is fraud that relies on the similarities between the person in charge of the fraud and the target of the fraud. In the Madoff case, Bernie Madoff relied on his religious and ethnic bonds to potential investors. These common bonds often cause potential investors to be less diligent than they ordinarily would be.
- *Proper due diligence may have uncovered early warning signs.* These signs included the fact that Madoff's firm administered, executed, and cleared trades in-house; and that Madoff's investment return profile was inconsistent with the stated investment strategy. If a competent third party had conducted the audit or fund administration, the fraud would have been much harder to conceal.
- *Investors should be aware of their potential responsibilities in the event of investment fraud.* When investors unknowingly profit from a fraud, such as a Ponzi scheme, they can be legally obligated to return any fund distributions (i.e., pay restitution).

Lancer Group

Lancer Group was an equity-based hedge fund managed by Michael Lauer. The investment strategy relied on using both private and public small-cap equity securities. Initial investor contributions to the fund exceeded $600 million. During the course of operations, Lancer achieved a stated high watermark of $1.2 billion in assets and $600 million in equity. However, in the aftermath of its implosion, the final valuation of the Lancer portfolio was $70 million. Lancer's collapse serves as yet another reminder of the importance of due diligence and the need for investors to monitor fund managers.

Lessons from Lancer

Lessons learned from the Lancer case include:

- *Funds with no transparency can be dangerous.* Lancer's portfolio was illiquid. As a result, Lauer chose to keep all positions held by the fund private in order to prevent other traders from taking advantage of this information and harming the hedge fund. However, the lack of transparency prevented investors from examining the risks of their investment and from hedging these risks. If Lauer had offered at least limited transparency, such as letting investors know that he held large positions in illiquid unregistered securities, investors would have better understood the risks associated with Lancer.
- *Be suspicious of internal valuations.* Rather than having an external party value Lancer's illiquid securities, Lauer performed these valuations himself. This lack of objective appraisal is a clear conflict of interest, as the higher the value Lauer attached to the securities, the higher the fees Lauer earned.

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- *Beware of window dressing.* While window dressing can be legal when done correctly, Lancer's attempts at window dressing were illegal. **Window dressing** involves portfolio transactions or valuations made just before the end of a reporting period to improve the valuation and/or appearance of a portfolio. At Lancer, Lauer allegedly engaged in **painting the tape**, which involves manipulating the market prices of securities in the portfolio to record low or high prices on the public transaction record. This illegal practice is often performed just before the close of the reporting period so that the portfolio is valued higher.
- *Ensure adequate audit and regulatory safeguards.* While Lancer hired a major accounting firm to verify its financial statements and financials, the audits failed to clearly identify the conflict of interest issues associated with some of Lancer's investment valuations. In addition, the auditing firm found that 10 of Lancer's investments appeared to have excessive valuations and requested investment appraisals on these firms. Despite the fact that only four appraisals were actually completed and that these were conducted by a biased party, the accounting firm still signed off on Lancer's valuations. In addition, Lancer violated the SEC's regulation requirements by not filing Form 13D for 15 holdings in which it held a 5% or greater ownership stake. If these reports had been filed and thoroughly examined (or if investors had been informed of these violations), Lancer's investors may have had a better understanding of Lancer's its risks.

Professor's Note: While originally convicted, Michael Lauer was eventually acquitted of fraud charges.

Lessons Learned From Cases in Tail Events

LO 29.4: Demonstrate knowledge of four major lessons from analysis of fund failures.

For example:

- **Discuss the lessons that emerge from the analysis of various types of hedge fund failures.**

Four major conclusions can be drawn from the hedge fund collapses and frauds discussed previously.

1. *The impact of leverage.* While significant amounts of leverage may create spectacular returns, it is evident that it may also create spectacular collapses. Leverage is a double-edged sword that magnifies both gains and losses.

2. *Overconfidence can be dangerous.* Markets and securities may not revert back to historical norms. Fund managers who are attempting to profit from a perceived market discrepancy may instead be failing to realize that behavioral biases are preventing them from seeing that the market has fundamentally changed. Naïve managers may continue to accrue large losses and increase leverage levels in an attempt to capitalize on an expected return to normalcy, but even if their forecasts are correct, the funds may be forced to liquidate due to short-term catastrophic losses. Hedge funds cannot rely on assistance from banks and prime brokers when trouble occurs, especially if the trouble occurs at the market level. Banks and prime brokers have a responsibility to protect their collateral and are unlikely to offer greater flexibility in times of market crises.

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3. *Predicting all risks is impossible.* It is important to have measures that detect, mitigate, and assess risks in quantitative financial systems.

4. *Large fees of the hedge fund world attract geniuses and crooks.* Regulation alone is insufficient. Due diligence is required to separate the two groups.

In the end, investors must be careful not to rely on regulations, audits, or industry organizations to inform them of fraudulent or unnecessarily risky funds. Instead, hedge fund investors must carry out a proper level of due diligence. While this exercise is costly and time consuming, investors must realize that this is a necessity for safely participating in the alternatives marketplace. In the case of Bayou, a little due diligence would have revealed that the independent auditor was in fact a sham. In the case of Bernie Madoff, warning signals were flashing for a number of years, and yet there was inaction on the part of the SEC. On the part of the individual investor, due diligence would have revealed that the accounting firm auditing Madoff was again a sham.

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Key Concepts

LO 29.1

Amaranth was a multistrategy hedge fund whose main strategy was a calendar spread strategy on natural gas prices. The strategy involved going long futures for winter contracts and short futures for nonwinter contracts. Lessons learned from the collapse of Amaranth include:

- Prime brokers can have a significant impact on the viability of a hedge fund.
- Multistrategy funds should be diversified and investors should confront managers if style drift becomes too severe.
- Fund managers should carefully monitor all of the fund's traders regardless of the size of their profits or past track record.
- Amaranth operated in largely unregulated arenas, specifically moving its natural gas trading to an unregulated market.
- Proper risk management is crucial. Stop-loss or concentration limits may help protect against extreme market events.
- The futures markets for some commodities are small enough that one fund can consume the majority of contracts.

Long-Term Capital Management (LTCM) was a hedge fund that collapsed in 1998. LTCM primarily focused on fixed-income arbitrage, and began to apply increasingly large amounts of leverage to their positions. When the Russian government defaulted on bond payments in August 1998, spreads in the financial markets widened, leading to large losses for LTCM and a resulting margin call from LTCM's prime broker. When LTCM found itself unable to meet this margin call, the fund was forced to try to liquidate positions into an increasingly illiquid market. This set LTCM into a downward spiral of additional margin calls and further liquidations. Lessons learned from LTCM include:

- Extreme leverage can turn a relatively low-risk strategy into a high-risk strategy.
- Market participants should be aware of the amount of leverage that counterparties have taken on.
- During extreme market events, liquidity will dry up and creditors will be reluctant to extend further credit.

Carlyle Capital Corporation (CCC) was an exchange-listed hedge fund that borrowed huge amounts of capital at short-term rates and purchased long-term AAA-rated mortgage bonds. To increase returns, the fund employed leverage of about 32 times. Lessons learned from the CCC collapse include:

- Mortgage securities that are backed by the faith of the U.S. government (either implicitly or explicitly) are not free from the risks of credit and liquidity crises.
- Hedge funds cannot rely on creditors to modify terms or prime brokers to extend liquidity during periods of distress.
- High levels of leverage, even if used with low-risk securities, can still have disastrous consequences.

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Behavioral biases include cognitive, emotional, and social biases that cause people to act in an irrational manner. Two common behavioral biases in financial markets are:

1. *Confirmation bias* refers to instances where individuals more heavily weigh information that agrees with their beliefs while discounting information that challenges their beliefs.

2. *Anchoring* refers to the fact that individuals seem to be anchored to a value or belief as if it has a gravitational pull. Anchoring can cause fund managers to be overly confident that markets or strategies that have earned them profits in the past will continue to earn profits in the future.

LO 29.2

Quant Meltdown of August 2007: Khandani and Lo explained this event using an unwind hypothesis, where one or multiple hedge funds tried to liquidate large positions. Because numerous hedge funds had used similar strategies and taken similar position, a crowded trade situation existed. This led to many funds trying to exit their similar positions by buying or selling the same security at the same time, sending those securities into a price spiral.

2010 Flash Crash: On May 6 of 2010 at 2:42 pm, equity prices plunged, losing 6% within minutes, then reversed to finish the day at nearly the same level at which the crash began. It was concluded that a trader had caused the crash by placing a sham order (spoof order) to sell $4.1 billion worth of E-Mini S&P 500 futures contracts into a market that was already thin and volatile. Circuit breakers exist to mitigate this kind of sudden crash and act by restricting trading in the event of significant market fluctuations. However, the illiquidity that accompanies circuit breakers may also have negative effects.

Knight Capital Group: In August 2012, Knight Capital Group installed a defective piece of software that caused Knight's trading systems to enter millions of erroneous orders. The company's value plunged by almost 75% in just two days. Knight was subsequently fined by the SEC for violating trading rules that require market participants to put controls in place to isolate the markets from this type of trading error.

LO 29.3

The Bayou Fund collapse was due to fraud perpetrated by Samuel Israel III and Daniel Marino. Israel and Marino falsified financial records, used commission rebates from a broker created by the firm (Bayou Securities) to hide losses, and created an accounting firm to serve as the independent auditor. Lessons learned from the Bayou fraud include:

- Investors should conduct background checks on the principals of a fund.
- Investors should demand hedge funds use a well-known, independent auditor.
- Investors should realize that regulations are not a suitable substitute for due diligence.

Bernie Madoff claimed to use an option collar strategy but was actually operating a massive Ponzi scheme. Madoff created fictitious financial reports indicating impressive results but was merely paying redemptions out of capital from new investors. Harry Markopolos approached the SEC on several occasions regarding Madoff, but the SEC was unsuccessful in its investigations. Lessons learned from Madoff's fraud include:

- Investors should be on the lookout for affinity fraud.

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- Proper due diligence may have uncovered the lack of a legitimate accounting firm and that the fund administered, executed, and cleared trades in-house rather than using a third-party firm.
- Investors that receive distributions can be forced to pay restitution if the distributions were the result of investment fraud even if they are unaware of the fraud.

Lancer Group was an equity-based hedge fund that relied on using both private and public small-cap equity securities. Lancer achieved a stated high watermark of $1.2 billion in assets and $600 million in equity. However, in the aftermath of its implosion, the final valuation of the Lancer portfolio was $70 million. Lessons learned from the Lancer case include:

- Funds with no transparency can be quite dangerous.
- Be suspicious of internal valuations.
- Beware of window dressing.
- Ensure adequate audit and regulatory safeguards.

LO 29.4

Conclusions from the hedge fund collapses and frauds include:

- The impact of leverage. While significant amounts of leverage may create spectacular returns, it is evident that it may also create spectacular collapses. Leverage magnifies both gains and losses.
- Overconfidence can be dangerous. Markets and securities may not revert back to historical norms. Fund managers who are attempting to profit from a perceived market discrepancy may instead be failing to realize that behavioral biases are preventing them from seeing that the market has fundamentally changed.
- Predicting all risks is impossible. It is important to have measures that detect, mitigate, and assess risks in quantitative financial systems.
- Large fees of the hedge fund world attract geniuses and crooks.

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Concept Checkers

1. The Amaranth Fund's main trading strategy could be *best* classified as:
   A. convertible arbitrage.
   B. a calendar spread on natural gas futures.
   C. capital structure arbitrage on mortgage-backed securities.
   D. a leveraged investment in AAA-rated government-backed mortgage bonds.

2. One of the contributing factors in the collapse of the Long-Term Capital Management (LTCM) hedge fund was:
   A. the Russian government defaulting on the payment of outstanding bonds.
   B. the downgrade of Ford and GM bonds to below-investment grade.
   C. the realization that securities backed by the government are not free from the risk of credit and liquidity crises.
   D. an unexpected decrease in the spread between the price of winter natural gas futures contracts and spring futures contracts.

3. The main trading strategy of the Carlyle Capital Corporation hedge fund could *most accurately* be classified as:
   A. convertible arbitrage.
   B. a calendar spread on natural gas futures.
   C. relative value strategies, such as fixed-income arbitrage.
   D. a leveraged investment in AAA-rated government-backed mortgage bonds.

4. John Dayton is the manager of a single-strategy hedge fund. The fund's historical annual ROA is 6% and its ROE is 18%. However, Dayton forecasts that changing market conditions will cause its ROA in the next year to decline to 3.5%. Assuming an interest rate of 3%, what level of leverage (i.e., ratio of portfolio assets to investor equity) should Dayton employ in order to maintain an ROE of 18%?
   A. 5 to 1.
   B. 9 to 1.
   C. 30 to 1.
   D. 36 to 1.

5. Which of the following hedge fund strategies was *least likely* to be negatively impacted by the Quant Meltdown of August 2007?
   A. Long/short equity.
   B. Equity market-neutral.
   C. Statistical arbitrage.
   D. Equity long-only.

6. A circuit breaker on a stock exchange is *least likely* to:
   A. mute market fluctuations.
   B. allow traders an opportunity to digest information.
   C. decrease risk that stems from concerns over illiquidity.
   D. give market participants time to formulate trading responses.

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7. While perpetrating their fraud, the managers of Bayou Fund:
   A. rebated commissions from their brokerage to hide trading losses but did not create an accounting firm to produce independent audits.
   B. created fictitious accounting records portraying profitable trades but did not create an accounting firm to produce independent audits.
   C. created an accounting firm to produce independent audits but did not rebate commissions from their brokerage to hide trading losses.
   D. rebated commissions from their brokerage to hide trading losses and created fictitious accounting records that were audited by the accounting firm they created.

8. Which of the following is *most accurate* regarding the case of Bernie Madoff? Henry Markopolos simulated the results of Madoff's stated:
   A. option collar strategy but never reported his findings to the SEC.
   B. calendar spread options strategy but never reported his findings to the SEC.
   C. option collar strategy and turned the results over to the SEC as evidence that Madoff's fund was a fraud.
   D. calendar spread options strategy and turned the results over to the SEC as evidence that Madoff's fund was a fraud.

9. Which of the following is the *least accurate* conclusion to be drawn from studying hedge fund collapses and frauds?
   A. Leverage acts as a double-edged sword on hedge fund returns.
   B. Successful hedge fund investing is dependent on proper due diligence.
   C. Prime brokers will not be sympathetic to hedge funds when their collateral is at risk.
   D. Hedge funds are dangerous and should be avoided.

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Concept Checker Answers

1. **B** The Amaranth Fund was a multistrategy fund that became overly concentrated in calendar spread bets on natural gas futures. The Carlyle Capital Corporation hedge fund invested in AAA-rated government-backed mortgage bonds using leverage. Convertible arbitrage is generally not considered a high-risk strategy. (LO 29.1)

2. **A** The Long-Term Capital Management (LTCM) hedge fund engaged in relative value strategies such as fixed-income arbitrage: its trades were based on expectations that the difference in prices between two similar securities would converge. However, the 1998 Russian bond default caused these price differences to widen, leading to large losses and margin calls for LTCM, and forcing the fund into a spiral of margin calls, liquidations, and eventual collapse. (LO 29.1)

3. **D** The Carlyle Capital Corporation hedge fund invested in AAA-rated government-backed mortgage bonds and raised capital by borrowing at short-term rates. The Long-Term Capital Management (LTCM) hedge fund engaged in relative value strategies such as fixed-income arbitrage, the premise for which is that the spread in prices or rates between two similar securities should converge over time. The Amaranth Fund was a multistrategy fund that became overly concentrated in calendar spread bets on natural gas futures. (LO 29.1)

4. **C** To determine the leverage level, we need to use the ROE formula:

   $ROE = (ROA \times L) - [r \times (L - 1)]$

   $0.18 = (0.035 \times L) - [0.03 \times (L - 1)]$

   $0.18 = (0.005 \times L) + 0.03$

   $L = 30$

   Assuming interest rates were unchanged, Dayton would need to increase the 5-to-1 leverage ratio to a 30-to-1 ratio. This large increase in leverage would cause the strategy to be sensitive even to relatively mild market declines. (LO 29.1)

5. **D** While the Quant Meltdown of August 2007 was causing tremendous losses for quantitative long/short equity hedge funds, equity markets overall (and equity long-only funds) were only mildly affected. The funds suffering the largest losses from the crisis were statistical arbitrage hedge funds and equity market-neutral hedge funds. The market-neutral strategy is an example of a long/short equity strategy. (LO 29.2)

6. **C** Despite being intended to benefit market participants, one criticism of circuit breakers is that they may increase risk associated with concerns over illiquidity if exchanges suspend trading. (LO 29.2)

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7. **D** Israel and Marino, the managers of Bayou, falsified financial records, used commission rebates from a broker created by the firm (Bayou Securities) to hide losses, and created an accounting firm to serve as the independent auditor. (LO 29.3)

8. **C** Henry Markopolos was suspicious of Madoff's results, so he simulated results of Madoff's option collar strategy, showing that Madoff's records were not valid. Markopolos turned those results over to the SEC as evidence that Madoff was running a fraudulent operation. (LO 29.3)

9. **D** Although there are dangers involved with investing in hedge funds, we should not conclude that hedge funds should always be avoided. The major conclusions are that leverage is a double-edged sword, that prime brokers will not be sympathetic to hedge funds when their collateral is at stake, and that markets and securities may not revert back to historical levels. Investors should conduct proper due diligence before purchasing alternative investments. (LO 29.4)

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The following is a review of the Risk Management and Portfolio Management principles designed to address the learning objectives set forth by the CAIA Association®.

Investment Process, Operations, and Risk

Topic 7.2

Exam Focus

In this topic review, we explore the investment process and operations of investment funds. There are two categories of risks to consider—market and operational. Style drift, operational errors, and fraud all contribute to operational risk. Investment process risk is the risk inherent in constructing and implementing an investment strategy. You should know the three main categories of the activities of a fund: investment, operational, and business. Additionally, a knowledge of how sound risk management systems control risks through tools such as risk limits and position limits is important. You should understand why objective valuation procedures and proper segregation of duties are key in terms of the fund's valuation process and custody of assets. Finally, you should understand put-call parity and how traders and fund managers manage delta, gamma, and vega.

Investment Strategy and Process

LO 30.1: Demonstrate knowledge of investment strategy and process.

For example:
- Contrast a fund's stated investment strategy and actual investment strategy.
- Contrast style drift with operational errors and fraud.
- Describe the components and stages of the investment process.

Stated vs. Actual Investment Strategy

In the wake of recent hedge fund failures and a financial market crisis, risk management is of critical importance. This topic review covers overall risk management processes and is not specific to hedge funds or particular strategies or styles. Of course, the risk of a fund is directly linked to the fund's investment strategy, so general principles must be applied to specific situations. As a first step in the risk management process, a manager must precisely identify the fund's strategy.

The **investment strategy** of a fund determines the objectives, methods, practices, and procedures that are used to create and alter the portfolio. In some cases, a manager may deviate from the **stated investment strategy** of the fund (what a well-informed investor would reasonably expect the fund's investment strategy to entail, based on information generated by the fund). The **actual investment strategy** is the strategy implemented at a particular point in time. The **permitted investment strategies** define the range of actions that a manager may take. Any deviations that are permitted must be clearly communicated to clients and prospective clients. Risk analysis should encompass not only the current fund strategy but permitted strategies as well. Risk managers should detect when the actual

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strategy is beginning to stray from the stated strategy. The **investment mandate** details the investment program. It provides a statement of the objectives and risks of the strategy as well as what investment actions are permitted within the confines of the stated strategy. Both the investment mandate and the stated investment strategy are usually disclosed in the standard documents provided to potential investors.

Style Drift, Operational Errors, and Fraud

There are three main reasons that the actual strategy may diverge from the stated strategy, including style drift, operational errors, and operational fraud.

1. **Style drift.** Style drift is the divergence of a fund from its stated investment style or objective. Managers often attempt to improve risk-adjusted performance by taking advantage of opportunities outside the stated strategy of the fund. Style drift is not a temporary divergence, such as a tactical asset allocation decision, but a change over time in the fund's investment strategy resulting from manager decisions.

2. **Operational errors.** Unintentional changes to the strategy may occur due to human error or poor risk management systems.

3. **Operational fraud.** If changes are intentional and blatantly disregard the interests of investors, the divergence is likely the result of fraudulent behavior by fund managers. Theft and the intentional misstatement of returns are examples of operational fraud.

Investment Process

The **investment process** is broad and includes formulating investment strategies, making investment decisions in order to implement the strategies, performing trades in order to execute the strategies, and monitoring performance. It is useful to think of the investment process in the following two stages:

1. Conceiving the strategy, developing the strategy, and specifying the components of the stated strategy.

2. Implementing the actual strategy.

Some managers may follow a primarily quantitative and systematic process whereby the analysis of the process looks at the software that implements and executes the investment strategy. Alternatively, other managers may follow a primarily discretionary process whereby the analysis of the process looks at the judgment and skill of the investment team.

The **investment management governance process** is important to the investor. It includes the procedures, either implied or overt, that are required to make investment decisions. Different firms have different cultures with respect to decision-making. Some firms have centralized processes whereby managers are closely controlled by an investment committee, for example. Other firms allow greater latitude on the part of portfolio managers. In either case, managers have some discretion to make decisions.

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Investment Process and Market Risk

LO 30.2: Demonstrate knowledge of investment process and market risk.

For example:
- **Contrast the general and narrower definitions of market risk.**
- **Discuss the causes of investment process risk and how it's detected.**
- **Describe the relationship between investment process risk and leverage.**
- **Describe how style drift relates to investment process risk.**
- **Discuss potential interactions of market risk with other investment risks.**

Definitions of Market Risk

Market risk is defined both generally and more narrowly. Generally speaking, market risk is the dispersion of economic outcomes that results from changes in market factors such as prices or interest rates. This is known as the **market risk in the investment process.**

More narrowly, market risk within asset pricing models is defined as systematic risk, the portion of the asset's total risk that is due to changes in the value of the market portfolio. Systematic risk cannot be diversified away. In this topic, we use the more general definition of risk, which includes both non-diversifiable (i.e., systematic) and diversifiable (i.e., idiosyncratic) risks.

Investment Process Risk

The imperfect application of a stated investment strategy by fund employees results in **investment process risk**. This risk is similar to operational risk and is sometimes considered a subset of operational risk. Investment process risk stems from the difference between the proper implementation of a strategy to achieve fund goals and the actual implementation of the strategy.

Quantitative risk assessment tools may be used to detect investment process risk. Comparing fund returns to benchmark returns is useful. Qualitative analysis may also identify issues. A clearly defined and well-designed investment process that establishes the functions of the investment team is important in the prevention of investment process risk. A process that maximizes the benefits of the investment strategy and minimizes the costs of investment process risk is optimal.

One of the issues with identifying and understanding process risk is the competing interests of providing transparency versus protecting proprietary information. An investor must understand the investment process in order to understand the risks associated with the investment strategy. However, a manager may be less than willing to divulge the details of the investment process because processes and procedures may contribute to his competitive advantage.

Quantitative strategies often rely on computer algorithms, which are procedures within the computer software that determine investment decisions (e.g., black box investing). A manager may be averse to disclosing all aspects of the computer algorithm, and investors must therefore decide whether they are willing to bear the risks of processes that they do not fully understand. A lack of transparency increases the process risk borne by the investor.

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If a fund is transparent in terms of investment processes, the processes must be examined in detail. The investor does not need to understand the computer code underlying the algorithms, but should definitely understand relevant variables included in the model. As an example, a convertible bond arbitrage strategy may include inputs such as the yield curve, the credit rating of the bond, the duration of the bond, the strike price of the conversion feature and the market price of the underlying stock, both historical and implied volatility, and provisions in the bond indenture, such as whether the bond is callable.

The bottom line is that investors must thoroughly understand the investment processes of a fund. They must use qualitative analysis, which includes:

- Organizational chart of the fund/firm.
- Investment personnel
  - Who are they?
  - What are the responsibilities of each individual on the team? How is it documented?
  - What are their backgrounds and qualifications?
- Investment committees
  - How are committee members selected?
  - How are officers selected?
  - How are agendas set for meetings?
- Meeting minutes
  - How are minutes recorded?
  - How are minutes approved?
  - How are minutes distributed?

The goal of the investor is to discover whether the investment process is vulnerable to incompetence, potential conflicts of interest, or in the worst-case scenario, fraud.

Investment Process Risk and Leverage

Two additional sources of investment process risk include: (1) the amount of leverage within a stated investment strategy, and (2) the possibility that leverage is used to a greater degree than specified in the investment mandate.

Additionally, a leveraged fund may be concerned if multiple managers follow the same strategy, known as *herd trading*. When one fund manager liquidates or reduces leverage (i.e., delevers) quickly, it may result in other managers doing the same. Ultimately, this can lead to rapid and large losses. To assess the risk of herd trading, one must understand the fund's positions, the positions of similar funds, the liquidity of relevant markets, and the potential market impacts if managers start to liquidate, delever, or both.

Investment Process Risk and Style Drift

Style drift, as previously discussed, is a major source of investment process risk. An investor decides to accept the risks and rewards of a stated strategy. If the fund manager drifts away from the stated strategy in search of higher returns, the manager may be investing in areas where she has little experience or expertise, increasing the risk to the investor.

Interactions Between Market Risk and Other Investment Risks

Market risk is exacerbated when it interacts with other investment risks caused by variances between the stated versus actual investment strategy. An incorrectly implemented investment process or unsuitable risk exposures may cause excessive losses to the fund

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during a market crisis due to the rapidly changing market prices. As a precaution, an analysis of investment process risk needs to consider how the fund can eliminate such errors, especially during periods of high market volatility.

Internal Fund Activities

LO 30.3: Demonstrate knowledge of the three internal fund activities.

For example:
- **Define investment activities.**
- **Define operational activities.**
- **Define business activities.**
- **Discuss how these three internal fund activities impact a fund in combination.**

The activities of a fund can be broadly classified into the following three categories:

1. **Investment activities.** All activities related to designing and implementing an investment strategy fall in this category (front office).

2. **Operational activities.** This category includes record keeping, data entry and processing, the reconciliation of trades, documentation, and other similar activities (middle and back office).

3. **Business activities.** Human resource management, non-investment accounting, maintenance of offices and other facilities, technology, infrastructure, and anything else that indirectly supports investment activities fall in this category. **Business risk** is the risk that results from problems or issues with the business team. For example, technological failures can lead to economic dispersions of outcomes.

Impact of Activities in Combination

A study by Kundro and Feffer[1] found the following regarding hedge fund risks:

- Operational risks contributed at least in part to 54% of hedge fund failures. Of these failures:
  - 41% were due to fraud (i.e., lying about investments and/or performance).
  - 30% were due to theft of assets.
  - 14% were due to style drift and unauthorized trades.
  - 6% were due to inadequate resources.
- Operational risk did not contribute to 38% of hedge fund failures. In other words, these hedge funds had only market risk factors. The fund's operational processes and controls were effective.
- Business risk and other factors contributed to the final 8% of hedge fund failures.

There is often a **synergistic risk effect** between market risk (i.e., the risk inherent in the stated strategy) and other risks. The combination or relationship of two or more risks may increase the total risk of the fund beyond that of the individual risks in isolation.

1. Kundro, Christopher and Stuart Feffer, *Understanding and Mitigating Operational Risk in Hedge Fund Investments*, (Capco 2005).

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Professor's Note: This is similar to the concept of diversification but with a twist. The idea here is that if market risk increases, (think high volatility as an example) then operational risks may also increase (think about trading errors as an example). If trading errors increase in times of increased volatility, then the correlation coefficient is positive and total risk is higher than either of the two risks in isolation would imply. So the difference is that as long as returns are not perfectly positively correlated, risk is reduced in the example of diversification. Here, positive correlation actually implies increased risk relative to the risks in isolation. As a result, investors may be paying too much attention to market risk [which was the sole risk factor in 38% of hedge fund failures in the Kundro and Feffer (2005) study] and not enough attention to operational risk (which resulted in 58% of failures) or the relationships between operational risks and market risks.

Operational Risk

LO 30.4: Demonstrate knowledge of operational risk.

For example:
- **Discuss the two interpretations of operational risk.**
- **Identify and describe operational errors.**
- **Identify and describe types of agency conflicts.**
- **Identify and describe operational fraud.**

Interpretations of Operational Risk

As with market risk, we will define operational risk generally and then more narrowly. The broad definition of **operational risk** is any deviation of the actual return from the expected return of the stated strategy resulting from operational failures within the fund. Imperfect implementation of a stated strategy results in operational risks. In this topic review, the broader view of operational risk is generally used.

The narrower view of operational risk excludes the firm's investment processes and business operations from risk analysis. These functions include the actions of investment team members as well as ordinary business functions such as human resource management and the maintenance of facilities. This view does include risks that arise from middle and back office operations.

Operational Errors, Agency Conflicts, and Operational Fraud

Ideally, an investor who is consistently monitoring a fund will detect potential operational risks early and will withdraw their investment before the fund fails. The three primary sources of operational risk are as follows:

1. *Operational errors.* Such errors result from unintentional mistakes (very small to very large) made while executing a fund's strategy. The resulting losses may be amplified in the presence of market risk. During normal market conditions, errors in executing trades are less likely and will have less impact (because prices are not likely to move significantly) compared to volatile market conditions. In volatile markets, errors become more likely and they are more difficult to detect. As well, prices may move significantly

before the errors can be fixed. Well-designed and implemented operational systems reduce, as well as detect, operational errors.

2. *Agency conflicts.* Fund employees act on behalf of investors. However, their interests may be in conflict. Compensation plans are used to align the interests of investors and employees but may not always work. An extreme example of a conflict of interest is a **rogue trader**. A rogue trader establishes large positions that are outside the fund's investment mandate. Often, pressure to perform, along with large losses that must be recouped, leads traders to poor decisions. Inadvertent incentives to game the compensation system can also be a problem in funds. In the case of **gaming**, managers attempt to generate gains that will lead to higher compensation without concern for potential losses to investors.

3. *Operational fraud.* The most severe instances of operational fraud, such as the Bernie Madoff case, generally result in the collapse of the fund. Any calculated, misleading, self-serving behavior by a fund employee that is harmful to investors is considered operational fraud. It is important to have checks, balances, and segregation of key duties in order to prevent operational fraud. For example, asset valuation, trading, risk management, and portfolio management duties are incompatible with one another and therefore should be performed by different individuals.

Controlling Operational Risk

LO 30.5: Demonstrate knowledge of methods for controlling the operational risk of an investment.

For example:
- **Explain how incentives can increase operational risk.**
- **Discuss how internal control procedures can detect and reduce operational risk.**
- **Explain the importance of valuation procedures and independence in the valuation process.**
- **Define custody, and explain how it relates to operational risk.**
- **Identify and describe the concept of fund culture and how it affects operational risk.**

The main actions a firm can take to control operational risks are:

- **Prevention.** Develop sound operational systems and hire and train quality personnel who have no or minimal conflicts of interest and who operate with integrity and are willing to admit mistakes. Employees should care about the integrity and reputation of the firm.
- **Detection.** Systems should not only be structured to prevent operational risks but also to detect them if they occur.
- **Mitigation.** Managers and other firm personnel must seek to remedy problems as quickly as possible, mitigating the costs associated with operational failures.

In some cases managers have incentives to manipulate reported performance and/or increase or decrease risks in order to game investors by reporting better risk-adjusted performance. Several issues related to this type of operational risk are discussed in the following section.

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Incentives and Operational Risks

Managers and other personnel want to remain employed. This means attracting new assets and retaining existing assets. To do this, the firm needs to report strong performance that is consistent across time. Also, compensation is often tied to high, consistent returns. Unfortunately, this pressure to perform can lead to unintended consequences for a firm. For example, managers may have an incentive to:

- **Reduce the risk of a fund** after a period of high returns to lock in performance. This allows the fund manager to maintain an acceptable level of return to meet performance objectives tied to incentives, even if this is an inferior strategy for the fund.
- **Increase the risk of a fund** after a period of losses to try and recoup what has been lost and get back to an acceptable level of return based on incentives. In particular, a rogue trader has a strong incentive to recoup losses because he has been acting outside the limits of the investment mandate. Recouping losses by taking excessive risks may be the only way for a rogue trader to save his career.
- **Increase risks, in the hope of increasing returns, so that a manager can earn the performance-based fee.** Performance-based fees are like call options. The "moneyness" of the option affects the manager's incentive to increase risk. For example, a manager is likely to increase risk when a fund is below its high watermark and the risk will likely remain high until the manager's option is substantially in the money.

Performance-based compensation may lead to increased (or decreased) risk taking by managers. To protect against this source of operational risk, firms must measure and monitor the returns and risks of individual managers as well the combined risks across fund managers. The goal of the firm is to prevent and control these risks. Internal control procedures are the primary method to detect and control risks.

Internal Control Procedures

Risk limits and position limits are used to control risk. **Risk limits** refer to the total risk level that is allowed in the portfolio. **Position limits** restrict the position size of a single security or collection of securities. Positions are electronically monitored. Typically, orders that would cause positions to exceed the imposed limits are prevented.

If traders are permitted to hide the size of positions and/or trading losses, the firm is at serious risk of large losses. Also, some traders and fund managers may identify holes or errors in risk management systems and choose to exploit those errors. Risk managers must have the authority to design systems that prevent this type of behavior.

While position limits are easily enforced, risk limits are not. For example, market volatility can cause risk measures, such as value at risk (VaR), to change even when no other transactions have been made. Also, preventing the violation of position limits is objective. Appropriate responses are more nebulous when it comes to preventing and correcting risk limit violations.

Valuation Procedures

Funds are chosen by investors based largely on performance. Also, compensation is usually tied to performance. This means that the valuation of assets is extremely important

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and potentially fraught with conflicts of interest. These conflicts of interest may induce managers to:

- **Obscure fund losses** to avoid reporting poor performance.
- **Smooth returns** so that volatility appears lower and risk-adjusted returns appear higher. Managers may shift high profits to periods of lower performance and shift losses to periods of high performance. This can be done by placing lower values on assets at the end of high performance periods and higher values on assets at the end of poor performance periods.
- **Vary risks.** As discussed above, managers may decrease risk to lock in profits or increase risk to recoup losses.

Objectivity and independence are critical components of the valuation process. It is easy to value exchange-traded funds (ETFs) using market data and position reports from custodians, prime brokers, and administrators. For less liquid assets such as mortgage-backed securities, external dealer quotes should be used rather than values supplied by the trading desk. Subjective valuations give rise to operational risks.

Custody of Assets

The safety of cash and assets is important to investors. The safekeeping of assets is called the **custody** of assets. There must be controls in place that safeguard the movement of assets. Concerns include:

- How assets are segregated (i.e., for individuals or investors as a whole).
- Whether there are controls in place to prevent fund managers from moving assets into their own private accounts.
- Whether manager assets are kept separate from fund assets (e.g., the European prime broker operations and the Lehman Brothers bankruptcy).

One way to protect assets is through **managed accounts**, where assets remain in the investor's account at the brokerage firm, but are managed by the hedge fund manager. In this case, the investor retains asset custody and the fund manager cannot withdraw capital. Also, an investor can view performance in real time because they have access to account positions and balances. Valuations will be determined by the custody bank or broker, rather than by the hedge fund manager.

Fund Culture

The **fund culture** reflects the values and priorities of fund managers and other personnel within a firm. Some firms operate with integrity and manage to instill that value throughout the organization and provide a strong defense against operational risk. Other firms break the rules and cross lines. This lack of integrity can be seen throughout the firm. Investors should seek companies that adhere to the highest professional standards. Investors can educate themselves about the firm's culture through review of employee compensation (including the use of performance fees) and assessing the risk management process and systems.

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Portfolios with Options

LO 30.6: Demonstrate knowledge of methods for controlling the risk of portfolios with options.

For example:
- **Describe how put-call parity can be applied to hedge a position.**
- **Discuss how option sensitivities can be used to analyze and hedge a position or portfolio.**
- **Discuss how options can be used as a bet on volatility.**

Put-Call Parity and Hedging

The combination of a put, a call, and an underlying asset can create a hedge in the form of a riskless bond. This **put-call parity** relationship is expressed in the following equation:

put – call + stock = riskless bond

That is, a long position in a put, a short position in a call, and a long position in an underlying stock removes risk. The long put removes the downside risk exposure from the long stock position. The short call gives up the profit from potential increases in the underlying stock. Assumptions include no dividend payments and options that may only be exercised at expiration (i.e., they are European options). Also, the expiration date and strike price must be the same for the put and the call. The result is a riskless cash flow equal to the strike price at expiration.

Why does this relationship hold? It holds due to the following potential scenarios:

- If stock price > exercise price, the short call is exercised, the put option is worthless and the stock is sold for the strike price.
- If stock price < exercise price, the long put is exercised, the call option is worthless and the stock is sold for the strike price.
- If the stock price = exercise price, both options are worthless and the stock is sold for the strike price.

The bond is a riskless asset with a face value equal to the strike price of the options and a maturity date equal to the expiration date of the options.

Using Option Sensitivities to Hedge

The *Greeks* provide a way to measure the sensitivity of option values to quantitative factors, such as the change in the price of the underlying asset. A summary of the Greeks is as follows.

- **Delta** measures the sensitivity of the option's theoretical value to a change in the price of the underlying asset.
- **Gamma** measures the rate of change in the delta for each one-point increase in the price of the underlying asset.
- **Vega** measures the sensitivity of the price of an option to changes in volatility.

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The following figure summarizes the sensitivities assuming that strike prices and expirations dates are equal for puts and calls.

Figure 1: Option Sensitivities

	+ *Put*	+ *Call*	+ *Stock*	+ *Put* – *Call* + *Stock*
Delta	$\delta - 1$	δ	1	0
Gamma	γ	γ	0	0
Vega	ν	ν	0	0

*Where δ = delta of a call option, γ = gamma of a call option, ν = vega of a call option

Note that gamma and vega are the same for puts and calls with identical strike prices and expiration dates because a long put and a short call must be gamma and vega neutral. The delta risk of puts and calls with identical strike prices and expiration dates have opposite signs and differ by one. Also note that the delta, gamma, and vega are zero in the above put-call parity example. Thus, for (put – call + stock), delta, gamma, and vega are zero (i.e., delta, gamma, and vega neutral).

Delta Neutral Portfolios

A long call, short put position, or short call, long put position, is hedged with respect to gamma and vega risk. However, based on Figure 1, it is apparent that a long call, short put position will have a delta exposure of +1 and a long put, short call position will have a delta exposure of –1 (both positions will neutralize gamma and vega risk, however). To eliminate the delta risk, the trader would take either a long position in the underlying stock (to add delta = +1) or a short position in the underlying stock (to add delta = –1). This creates the delta neutral position represented by put-call parity.

If options do not have identical strike prices or expiration dates, traders can manage gamma and vega by taking long positions in calls or puts (buying gamma and/or vega) or taking short positions in calls or a puts (shorting gamma and/or vega).

Options as Volatility Bets

Traders often bet on volatility and use the position in the underlying asset to hedge. They view the underlying asset as a slack variable. A **slack variable** does not affect the value of an objective function (in this case the underlying asset does not directly contribute to alpha or affect gamma and vega) but can take on whatever value is necessary to allow for optimization. In this case, the position in the underlying asset protects the portfolio from directional movements in the market. In other words, the underlying asset controls the delta in a bet on volatility.

Traders take long positions in options to place directional bets on underlying assets. Options have limited downside risk as well as positive skew. They also provide leverage. This is attractive to sophisticated, aggressive traders who believe that the underlying assets are mispriced.

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Traders use short positions in options when they perceive that volatility is mispriced in the market. Since the trader maintains a delta-neutral position, traders view the mispriced options as bets on volatility.

Professor's Note: Consider the use of options in placing bets on volatility. If volatility is overpriced, the option premium is too high. The trader sells the option, receiving the overvalued option premium. Because the trader maintains delta neutrality, he is able to generate alpha based solely on the mispriced call or put (i.e., the mispriced volatility).

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Key Concepts

LO 30.1

The stated investment strategy of a fund is what actions a well-informed investor could expect the fund to take, based on provided information, whereas the actual investment strategy is the strategy implemented at a particular point in time.

The three main reasons that an actual investment strategy may diverge from the stated investment strategy are:

1. Style drift. Style drift is the divergence over time of a fund from its stated investment style or objective.

2. Operational errors. Unintentional changes to the strategy may occur due to human error or poor risk management systems.

3. Operational fraud. If changes are intentional and blatantly disregard the interests of investors, the divergence may be an example of fraudulent behavior by fund managers.

The investment process is broad and includes formulating investment strategies, making investment decisions in order to implement the strategies, performing trades in order to execute the strategies, and monitoring performance. It consists of two stages:

Stage 1: Strategy conception, development, and component specification.

Stage 2: Strategy implementation.

LO 30.2

Market risk in the investment process is the dispersion of economic outcomes that result from changes in market factors, such as prices or interest rates. More narrowly, market risk within asset pricing models is defined as systematic risk or the portion of the asset's total risk that is attributable to changes in the value of the market portfolio.

The imperfect application of a stated investment strategy by fund employees results in investment process risk. Investment process risk stems from the difference between the proper implementation of a strategy to achieve fund goals and the actual implementation of the strategy. Quantitative risk assessment tools may be used to detect investment process risk. Comparing fund returns to benchmark returns is useful. Qualitative analysis may also identify issues.

Two additional sources of investment process risk include: (1) the amount of leverage within a stated investment strategy, (2) the possibility that leverage is used to a greater degree than specified in the investment mandate. Additionally, a leveraged fund may be concerned if multiple managers follow the same strategy, known as herd trading.

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Style drift refers to a fund manager drifting away from the stated strategy in search of higher returns. The manager may be investing in areas where she has little experience or expertise, increasing the risk to the investor.

Market risk is exacerbated when it interacts with other investment risks caused by variances between the stated versus actual investment strategy.

LO 30.3

The internal activities of a fund can be broadly classified into the following three categories:

1. Investment activities. All activities related to designing and implementing an investment strategy fall in this category (front office).

2. Operational activities. This category includes record keeping, data entry and processing, the reconciliation of trades, documentation, and other similar activities (middle and back office).

3. Business activities. Human resource management, non-investment accounting, maintenance of offices and other facilities, technology, infrastructure, and anything else that indirectly supports investment activities fall in this category.

There is often a synergistic risk effect between market risk (i.e., the risk inherent in the stated strategy) and other risks. The combination or relationship of two or more risks may increase the total risk of the fund beyond that of the individual risks in isolation.

LO 30.4

Operational risk is defined broadly and more narrowly. The broad definition of operational risk is any deviation of the actual return from the return of the stated strategy resulting from operational failures within the fund. Imperfect implementation of a stated strategy results in operational risks. The narrower view of operational risk excludes the firm's investment processes and business operations from the risk analysis.

The three primary sources of operational risk are:

1. Operational errors. These errors result from unintentional mistakes made while executing a fund's strategy.

2. Agency conflicts. Fund employees act on behalf of investors. However, their interests may be in conflict. An extreme example of a conflict of interest is a rogue trader who establishes large positions that are outside the fund's investment mandate.

3. Operational fraud. Any calculated, misleading, self-serving behavior by a fund employee that is harmful to investors is operational fraud.

LO 30.5

The pressure to perform can have unintended consequences. Managers may have an incentive to:

- Reduce the risk of a fund after a period of high returns to lock in high performance numbers.

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- Increase the risk of a fund after a period of losses to try and recoup what has been lost and get back to an acceptable level of return based on incentives.
- Increase risks, hopefully increasing returns, so that a manager earns the performance-based fee.

Risk limits and position limits are used to control risk. Risk limits are the maximum levels of measured risk that are allowed in the portfolio. Position limits restrict the size of the holdings of a particular security or collection of securities.

The valuation of assets is extremely important and potentially fraught with conflicts of interest. These conflicts of interest may induce managers to obscure fund losses, smooth returns, and vary risks. Objectivity and independence are critical components of the valuation process. It is easy to value exchange-traded funds (ETFs) using market data and position reports from custodians, prime brokers, and administrators. For less liquid assets such as mortgage-backed securities, external dealer quotes should be used rather than values supplied by the trading desk.

The safety of cash and assets is important to investors. The safekeeping of assets is called the custody of assets.

The fund culture reflects the values and priorities of fund managers and other personnel within a firm. Investors concerned with operational risk should seek fund cultures that have ethical standards of conduct.

LO 30.6

Put-call parity indicates that the combination of a put, a call, and an underlying asset can create a riskless hedge. The relationship is expressed as:

$$\text{put} - \text{call} + \text{stock} = \text{riskless bond}$$

The Greeks provide a way to measure the sensitivity of option values to quantitative factors, such as the change in the price of the underlying asset. They are:

- Delta measures the sensitivity of the option's theoretical value to a change in the price of the underlying asset.
- Gamma measures the rate of change in the delta for each one-point increase in the price of the underlying asset.
- Vega measures the sensitivity of the price of an option to changes in volatility.

A long call, short put position will have a delta exposure of +1 and a long put, short call position will have a delta exposure of –1. To eliminate the delta risk, the trader would take either a long position in the underlying stock (to add delta = +1) or a short position in the underlying stock (to add delta = –1). This creates the delta neutral position represented by put-call parity.

Traders often bet on volatility and use the position in the underlying asset to hedge. They view the underlying asset as a slack variable, a sort of adjustment figure that makes the strategy work.

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Concept Checkers

1. Which of the following is **NOT** a reason that actual investment strategies may differ from stated investment strategies?
   A. Fraud.
   B. Operational errors.
   C. Poor computer algorithms.
   D. Style drift.

2. Which type of risk is the primary risk contained within a stated investment strategy?
   A. Market risk.
   B. Operational risk.
   C. Investment process risk.
   D. Value at risk.

3. When fund managers attempt to generate gains to meet performance targets tied to compensation without regard to potential losses to investors, they are engaging in:
   A. fraud.
   B. gaming.
   C. herd trading.
   D. style drift.

4. Blueguard Funds finds that its employees are making mistakes in placing orders that result in an actual strategy that looks quite different from that specified in the investment mandate. This strategy deviation would *most likely* be classified as what type of risk?
   A. Governance risk.
   B. Investment process risk.
   C. Market risk.
   D. Idiosyncratic risk.

5. Which of the following is the term for a risk management tool that restricts the size of the holdings of a combination of securities?
   A. Value at risk measure.
   B. Risk limit.
   C. Algorithm.
   D. Position limit.

6. When one type of risk leads to increases in another type of risk, there is said to be:
   A. synergistic risk effects.
   B. risk budget breakdowns.
   C. risk limit allocation risk.
   D. excessive total fund risk.

7. The vega of a long put and a long call with same expiration dates and strike prices is:
   A. the same.
   B. of opposite signs but the same magnitude.
   C. of the same sign but different magnitudes.
   D. equal to delta minus 1.0.

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8. The act of gaming by managers is *best* described as an example of a(n):
   A. agency conflict.
   B. business risk.
   C. operational error.
   D. operational fraud.

9. The overall delta exposure of a short call, long put position with a long position in the underlying stock is *closest* to:
   A. 0.
   B. +1.0.
   C. –1.0.
   D. –2.0.

10. In terms of internal fund activities, front office activities are *most accurately* categorized as:
   A. business activities.
   B. investment activities.
   C. operational activities.
   D. risk management activities.

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Concept Checker Answers

1. **C** Computer algorithms are used in quantitative investment strategies. They are the procedures within the computer software that determine investment decisions. They do not result in actual strategies differing from stated strategies. There are three main reasons the actual strategy may differ from the stated strategy: style drift, operational errors, and operational fraud. (LO 30.1)

2. **A** The primary risk of the stated strategy is market risk. Operational risks, investment process risks, fraud, and rogue trading result from the implementation of the actual strategy. (LO 30.2)

3. **B** When managers attempt to generate gains to earn performance-based fees with total disregard for investors, they are gaming. Style drift occurs over time as managers make decisions that move the actual strategy away from the stated strategy. (LO 30.2)

4. **B** The imperfect application of a stated investment strategy by fund employees results in investment process risk. (LO 30.2)

5. **D** Position limits are easier to enforce than risk limits because they restrict the size of holdings of a security or combination of securities. A risk limit sets a maximum for the level of measured risk allowed in the portfolio. (LO 30.5)

6. **A** The combination or relationship of two or more risks that increase total risk is an example of synergistic risk effects. (LO 30.3)

7. **A** Vega measures the sensitivity of the price of an option to changes in volatility. It is the same for a put and a call with the same expiration dates and same strike prices. (LO 30.6)

8. **A** Gaming occurs where managers attempt to generate gains that will lead to higher compensation without concern for potential losses to investors. Therefore, it is best described as an example of an agency conflict. (LO 30.4)

9. **A** A short call, long put position will have a delta exposure of –1. By adding a long position in the underlying stock, we increase delta by +1, which results in a delta neutral position. (LO 30.6)

10. **B** Front office activities relate to designing and implementing an investment strategy. Therefore, they are best categorized as investment activities. (LO 30.3)

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The following is a review of the Risk Management and Portfolio Management principles designed to address the learning objectives set forth by the CAIA Association®.

Due Diligence of Fund Managers

Topic 7.3

Exam Focus

This topic review provides an in-depth look at the seven phases of the due diligence process for researching a fund manager. Due diligence is an opportunity for a potential investor to analyze a fund's operations and investment process in order to determine whether the manager is truly the best available. There is a lot of detail that goes into such a methodical process, which is reflected in this topic review. Don't let that scare you, however, because a significant amount of the material focuses on simple definitions. If you memorize the definitions and have a working knowledge of investor concerns in each of the seven phases of the due diligence process, you should be in good shape to answer questions related to due diligence on the exam.

The Due Diligence Process

LO 31.1: Demonstrate knowledge of due diligence evidence and organization.

For example:

- **Identify evidence for and organization of a due diligence process.**

Because approximately 50% of hedge fund failures are due to operational risk, it is imperative that investors carefully conduct due diligence on potential managers. In addition, proper due diligence ensures that the investor's objectives (e.g., risk, return) and constraints (e.g., legal and tax) are able to be met by the fund. **Due diligence** is a disciplined approach for finding the best possible fund manager. The due diligence process consists of seven phases:

1. Structural review.
2. Strategic review.
3. Administrative review.
4. Performance review.
5. Risk review.
6. Legal review.
7. Reference review.

The purpose of the remainder of this topic review is to discuss the key factors an investor should look for in each of the seven phases of the due diligence process.

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Understanding the Investment Program

LO 31.2: Demonstrate knowledge of the three questions critical to understanding the nature of a manager's investment program.

For example:
- **Define and describe due diligence processes related to investigation of investment objectives of hedge funds.**
- **Define and describe due diligence processes related to investigation of investment processes of hedge funds.**
- **Define and describe due diligence processes related to investigation of how hedge fund managers add value.**
- **Describe and contrast information gathering and information filtering.**

There are three essential questions a potential investor should ask in order to understand the nature of a fund manager's investment program:

1. *What is the fund's investment objective?* The investment objective (i.e., the fund manager's goal) should be stated in a clear and concise manner. A valid investment objective may be stated in as little as one sentence.

2. *What is the fund manager's investment process?* The manager should describe the **investment process**, which details how securities are selected and how returns are generated. For example, identifying whether the manager uses quantitative models or fundamental research provides valuable insights into the manager's process.

3. *What is the fund manager's competitive advantage or value added?* We want to know why a particular manager is better than another fund manager who follows a similar strategy.

By asking these questions, investors are able to screen out unwanted fund managers that fail to merit the time and cost required to perform proper due diligence.

Investment Objectives

In order to answer the first question, "What is the fund's **investment objective**?" a potential investor should ask three further questions:

1. *What is the fund manager's investment universe?* We want to know what types of securities, or target markets, a manager pursues. For example, a manager specializing in mortgage-backed security (MBS) arbitrage may only invest in mortgage-backed securities and U.S. Treasury bonds, while a global macro manager may invest in any possible type of market or security.

2. *What is the general investment strategy of the fund?* The strategy should be specific. Simply saying that the manager wants to generate a positive return is not enough because no manager invests with the goal of losing money. An appropriate strategy statement will identify how the fund invests capital. For example, stating that a fund follows a long/short strategy or a merger arbitrage strategy is an adequate answer to the question.

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3. *Does the fund manager have a benchmark, and if so, what is it?* Most fund managers try to generate positive returns regardless of the direction of the market and do not rely on tracking a specific benchmark. However, some managers, such as a long/short manager, may try to use fund strategies to outperform a broader market index such as the S&P 500.

The Investment Process

A **black box** investment process uses a quantitative computer algorithm preprogrammed by the fund manager to generate investment decisions. Once the manager uses investment skills to develop the computer program, the black box becomes the proprietary investment process and makes all buy and sell decisions.

Investment process risk is an unquantifiable, idiosyncratic, manager-specific risk that arises from the operations of a firm. Investment process risk is also referred to as *uncompensated risk* because it is not part of the fundamental economic risk that is inherent in an investor's asset allocation. Taking on investment process risk cannot add to the investor's return, but it could sharply reduce return by distracting decision makers or causing a fund to fail. Because investment process risk cannot be measured and the investor does not receive any additional return, it is a risk that investors are unwilling to take. A **key personnel clause** can mitigate investment process risk by allowing investors to withdraw capital from a fund without penalty in the event that certain individuals no longer partake in the fund's investment decision-making process.

Understanding the Manager's Competitive Advantage

In identifying a manager's competitive advantage or source of added value, two questions are relevant:

1. How does the manager find alpha?

2. Why does the manager believe alpha will persist?

Two distinct information processing skills that can give a fund manager a competitive advantage are filtering information and gathering information. A successful fund manager must possess one or both of these advantages.

- **Information filtering** refers to the ability to look at a set of information and draw more meaningful conclusions than another manager who is looking at the same set of information.
- **Information gathering** refers to the ability to obtain a larger and better quality information set than another manager.

Maintaining the competitive advantage will be difficult over time since outperformance will tend to attract competition. Historical performance can indicate risk, but only careful analysis of data and the manager's competitive advantage on a forward-looking basis can indicate whether alpha will persist. Managers that continuously seek new alpha sources or have access to proprietary data are better positioned to maintain alpha.

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Structural Review Phase of Due Diligence

LO 31.3: Demonstrate knowledge of the due diligence of hedge fund structures.

For example:
- **Describe the main issues related to the review of a fund's organization.**
- **Discuss the master trust account structure, and recognize its uses by hedge funds.**
- **Explain the importance of reviewing fund managers' organizational structures.**
- **Discuss separation of duties and how organizational charts can be used to evaluate it.**
- **Recognize the importance of reviewing and documenting regulatory registrations.**
- **Describe evaluation and documentation of outside service providers, including the auditor, attorneys, and the prime broker.**

The purpose of the **structural review phase** of the due diligence process is to define how the fund is organized as a business entity and to identify the structure of the fund manager's operations. The fund and the fund manager are separate legal entities requiring a review of both structures. This phase also includes a review of any **regulatory registrations** the fund may have, a review of the fund manager ownership including key personnel at the firm, and an assessment of outside service providers to the manager (i.e., auditors, prime broker, legal counsel).

Master Trust

A **master trust** is used to invest a fund's assets in a way that accommodates multiple tax domiciles for funds that have both domestic and foreign investors. Because taxation policies for fund investors will differ depending on where they live, a fund manager will often set up two funds called **feeder funds** under one master trust. The first feeder fund is considered on shore, meaning that it is U.S. based, and the second feeder fund is set up off shore to accommodate foreign investors. The assets for the funds are invested through a single master trust so that the fund manager's investment process can be applied to both the on-shore and off-shore funds on a consistent basis. The structure of a master trust and feeder funds is appropriately known as the **master-feeder structure**.

The master trust structure itself is **tax neutral**, meaning there are no direct tax consequences at the master trust level. A master trust is usually set up in a location that does not have corporate income taxes, such as Bermuda or the Cayman Islands. This means that the master trust does not pay corporate taxes, which allows any tax consequences associated with the fund to flow down to the tax code of each investor's home country. Individual investors are responsible for paying the appropriate taxes to their respective governments.

The master trust is generally used to manage the assets of the fund. However, some funds use separate accounts for single investors who do not want to pool capital. Separate accounts must be analyzed to ensure similar fees and trade allocation as pooled accounts. **Side pocket arrangements**, which segregate difficult to value illiquid assets from other assets, may also be used to manage assets. Assets in side pockets are valued less frequently, which makes it difficult to treat investors entering and exiting the fund equally. Best practice is to include returns of side pocket assets with the entire fund.

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Organizational Questions

Relevant questions an investor should ask about the fund manager's organization include the following:

- *Where is the fund manager located?* If the fund manager is located overseas, time zone differences could create challenges in contacting the fund manager during normal business hours. An investor may also want to ask if the fund manager has satellite offices, and if so, which of those offices would be the most accessible for the investor.
- *What is the organizational structure of key personnel?* An investor should identify the chief executive officer (CEO), chief investment officer (CIO), and chief operating officer (COO). If all three are the same person, the investor should be wary of investing with the fund. The investor should also identify who is in charge of trading, information systems, and marketing.
- *What is the educational background and prior experience of principals of the firm?* An investor should identify whether principals have graduate degrees or professional designations such as the Chartered Alternative Investment Analyst (CAIA®) designation. An investor should also ask about the principals' prior investment experience before starting the fund.
- *How did the manager learn to short stocks?* Shorting stocks involves a different skill set than managing a long-only portfolio. If the fund strategy involves shorting stocks but the manager's previous experience was with a long-only portfolio, the manager may lack the experience and ability to effectively implement the short side of the fund's strategy.

Separation of Duties

Investors should obtain an organizational chart as part of the due diligence process. The chart should show the separation of duties among key personnel. Investment, operations, and management responsibilities should be divided among different personnel. These personnel should not all report to the same person.

The *chief financial officer* (CFO) is responsible for reporting the fund manager's performance results to investors. As a result, the CFO should have a strong accounting background and have an accounting designation, such as the Certified Public Accountant (CPA). The CFO is an investor's most important source of information regarding the fund's performance.

The investor should review the documentation defining the ownership structure of the fund manager. Special attention should be paid to who owns the company that advises the fund. Ownership could be an external party, active employees, or both. Giving active employees an ownership stake is an effective way to ensure retention of key employees, which can contribute to the stability of the investment process.

Investors must also understand how fund employees are compensated to ensure the interests of the employees are properly aligned with investors. To reduce conflicts of interest, performance-based compensation is typically used. Investors should determine if key employees have the potential to earn equity ownership or stock options in the firm and if investment decision makers are able to earn bonuses based on fund performance.

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Regulatory Registrations

A fund manager may be registered with regulatory bodies such as the Financial Conduct Authority (FCA) in the United Kingdom or the Securities and Exchange Commission (SEC) in the United States. Investors should verify these registrations are current and also check to see if there are any outstanding civil, criminal, or administrative actions pending against the manager.

Outside Service Providers

Outside service providers provide professional services that are vital to a fund's operations. Relevant outside service providers include the following:

- **Outside auditors**. Auditors are a good source of information about the fund manager's accounting system and operations. An investor should obtain both the most current financial statement and the most recent annual audited financial statement. If the auditors give anything other than an unqualified opinion on the financials, the investor should discuss the reason for the qualification with the auditors.
- **Attorneys/legal counsel**. The fund's legal counsel maintains regulatory registrations for the fund manager and prepares the offering document given to potential investors. For due diligence purposes, outside counsel should alert the investor to any civil, criminal, or administrative legal actions pending against the fund manager.
- **Prime broker**. The prime broker executes trades on behalf of the fund, lends securities to sell short, and provides financing for leverage. The prime broker's knowledge of the inner workings of the fund is only second to the fund manager. Because prime brokers are responsible for executing trades, lending securities to sell short, and providing the means for the fund to leverage its holdings, they are in the best position to know exactly what securities the fund holds at a given point in time. The process of lending securities to sell short exposes the prime broker to credit risk from the fund manager. If a short position moves against the fund, the prime broker can demand a **margin call**, which forces the fund manager to post cash or additional securities in the fund's account in order to cover the prime broker's credit exposure. In addition to a margin call, the prime broker can (1) demand that a fund sell outside positions to raise cash and (2) seize and liquidate capital to raise cash.

Given the importance of outside service providers, a fund should carefully select its auditor, legal counsel, and prime broker. Investors should verify the independence and reputation of all outside service providers. Investors can assess the quality of the outside service providers using their ranking in **league tables**, which are lists of firms ranked by size, volume, and other indicators of activity. Outside service providers used by a fund should be highly ranked in league tables.

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Strategic Review Phase of Due Diligence

LO 31.4: Demonstrate knowledge of the strategic review of fund managers in the due diligence process.

For example:

- **Explain the importance of understanding the markets and securities in which a manager invests.**
- **Discuss the issues related to benchmarking of fund returns.**
- **Describe key considerations in the analysis of managers' competitive advantages and sources of investment ideas.**
- **Describe key considerations in the review of managers' current portfolio positions.**
- **Describe key considerations in the review of the source of investment ideas.**
- **Discuss investment strategy capacity in the context of evaluating structural risk.**

The **strategic review phase** of due diligence involves documenting the style, target markets, and securities that a manager invests in for the purpose of understanding the manager's investment strategy.

Documentation of investment style. Investment style for a fund refers to the primary approach the fund manager uses to run the fund. In a previous topic, we discussed the major fund styles, although, many more styles exist. Proper documentation of style works best using a three-step, top-down approach:

Step 1: Document the type of fund strategy.
Step 2: Document the approach used within that strategy.
Step 3: Document how the manager implements the approach.

The top-down approach lets the potential investor narrow down the manager's primary investment strategy into a truly meaningful style. For example, consider a manager that follows a convergence trading strategy. We can further divide convergence trading into two approaches: economic arbitrage and statistical arbitrage. Economic arbitrage is a longer-term approach that compares prices between two securities on a fundamental basis. Statistical arbitrage involves much more frequent trading based on statistical irregularities in the market. Once we know the approach used, we can document whether the manager uses equities, bonds, or convertible bonds for implementing the style.

Documentation of investment markets. Knowing whether a manager invests in U.S. equity markets, international equity markets, currencies, or commodities is important for understanding a fund's investment strategy. In some cases, narrowing the manager down to a precise market may be impossible. A global macro manager can invest in anything, anywhere, and therefore cannot be tied down to a specific market. Any documentation of markets a manager invests in should also include a review of the manager's use of derivatives. Derivatives can be used to hedge or magnify investment risks; therefore, knowing exactly how derivatives are used is critical.

Documentation of investment securities. This step answers the question of what securities are used in the manager's process. Documenting this information is not designed to put restrictions on the manager but to understand each part of how the investment strategy works. The use of derivative securities such as futures, swaps, and options is of particular concern due to their leverage effects and potential for non-linear payoff profiles.

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Short Volatility

An example of using securities that can create a non-linear payoff profile is a short volatility strategy. A **short volatility strategy** is implemented by selling out-of-the-money call or put options against a portfolio. The manager is hoping that any movements in the price of the underlying security are small enough that the option will expire out-of-the-money and the manager can keep the option premium received. However, in the case of a call option that is sold "naked" (i.e., the seller does not hold the underlying stock), if the underlying security price moves dramatically, the options may be exercised, exposing the fund manager to potentially unlimited losses. The manager is said to be "short volatility" because increasing volatility in the price of the underlying security increases the risk that (1) the options will be exercised, and (2) the manager will lose money.

Benchmarking

Benchmarking, the process of relating a manager's performance to a particular standard, is extremely difficult for funds for the following reasons:

- An unmanaged passive securities benchmark is ineffective for measuring the skill of an active skill-based fund manager.
- Many fund strategies, such as a long/short or market-neutral strategies, cannot be adequately represented by a long-only benchmark.
- Most funds exhibit **portfolio concentration**, which means they hold large positions in a small number of securities in order for each security to have a bigger impact on the return of the overall portfolio. This means that the makeup of most hedge fund strategies is very different from that of a broad-based market index.

Despite the problems with benchmarking, a potential investor needs to establish some performance standard for the fund manager. Hedge fund investors may choose to use a fund style index, where applicable. A **fund style index** uses the aggregate performance of a group of funds that match the style of the target fund as a benchmark. For example, a merger arbitrage hedge fund could utilize the HFRI Event Driven: Merger Arbitrage index as a benchmark. Note that any substantial difference (positive or negative) in any return or correlation measures (e.g., mean, volatility, kurtosis, correlation with traditional assets) should cause the investor to investigate further to ensure the divergence is not due to style drift or fraud.

Hurdle rates can also be used to assess a fund manager whose performance cannot be adequately evaluated by a benchmark. In this case, the hurdle rate describes a return the manager should exceed over a certain time period. For example, an absolute return manager who is trying to achieve a positive return regardless of the direction of the market would be an appropriate candidate for using a hurdle rate as a performance standard.

Competitive Advantage

Investors must analyze the competitive advantage of the fund manager. This goes beyond the specialization that the manager may employ as part of the fund strategy. The competitive advantage relates to the differentiating factors that allow the manager to produce superior investment results within its strategy. For example, the manager may employ an unusually large legal team to more efficiently analyze and form an investment strategy related to announced deals.

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Current Portfolio Positions

A **portfolio snapshot** lets a potential investor see exactly what positions a manager is currently holding in the fund portfolio, including the leverage, size, and concentration of positions. If managers do not wish to report position-level data, they can report a position-level risk measure through a third-party risk system. When looking at the portfolio snapshot, a potential investor should assess the following items:

- *The long versus short exposure of the fund.* The investor should determine the manager's net market exposure.
- *How much cash the investment manager keeps within the fund.* Too much cash could signal that the manager lacks investment ideas.
- *How many different securities the manager holds.* A small number of securities is indicative of a concentrated portfolio and a greater amount of stock-specific risk.
- *How the portfolio is positioned relative to current market conditions.* The positioning of the portfolio will give a potential investor insight into the manager's current view of the market and the strategy the fund may follow in the future.

Idea Generation

Having a steady flow of successful investment ideas is essential for running a successful fund and represents the source of a manager's skill. The process used for idea generation is a key part of a fund's competitive advantage. For example, a fund may have an excellent research department or a complex computer program that generates ideas better or faster than other fund managers.

When looking at how ideas are generated, an investor should also determine when those ideas work the best. For example, some managers' ideas may work better in bull markets while some may work better in bear markets. In the case of an absolute return fund, ideas should work regardless of the market environment.

Capacity

Capacity refers to the amount of investor capital a fund manager can deploy and still implement the fund's investment strategy effectively. Factors that can limit capacity of a fund include the following:

- *Amount of portfolio concentration.* The fewer securities a fund holds, the less capital the fund will be able to successfully deploy.
- *Size of target market.* A fund that invests in a small market, such as convertible bonds, will be able to deploy less capital than a fund investing in a large market, such as global equities.

Capacity is an important issue for a potential investor because a fund with a large asset base and a small number of securities (i.e., large individual positions) could find that its own trades impact the market prices of securities, potentially reducing fund performance.

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Administrative Review Phase of Due Diligence

LO 31.5: Demonstrate knowledge of the administrative review of funds.

For example:
- **Discuss the importance of due diligence on the ethical and legal history of fund employees.**
- **Discuss the reasons for review of employee turnover.**
- **Discuss the ideal organization of investor relations.**
- **Describe the importance of business continuity management.**

The **administrative review phase** of the due diligence process looks at operational issues that may affect the fund manager and the manager's relationship with clients. Items to consider in the administrative review phase include the following:

- A background check to discover if any civil, criminal, or regulatory actions have been filed against the fund manager.
- Employee turnover.
- The investor relations team.
- Business continuity planning.

A fund manager should disclose all civil, criminal, and regulatory actions against the manager or any principal member that have occurred in the last three to five years. The two main reasons to review civil, criminal, and regulatory actions are as follows:

1. *To gain insight into the manager's character*. It is common for a fund manager or principal member to have past, or current, legal or regulatory proceedings, but recurring issues can reveal potential judgment problems at the fund.

2. *To uncover time-consuming legal and regulatory issues*. The manager and principal members should be focused on the day-to-day activities of the fund. Legal and regulatory issues can prevent them from properly managing the fund.

Employee Turnover

Employee turnover is a distraction to the investment process. If the fund manager is continually spending time and resources to search for and train new employees, the manager is spending less time and resources managing the fund. It will also take time for new employees to learn about the fund manager's strategy and have the ability to perform their jobs effectively. In addition, former employees may have been a key part of the fund's competitive advantage and their departure can reduce the fund's overall risk/return performance, especially if they join a competitor's fund. Investors should question a high amount of turnover. If the employees find it difficult to work with a fund manager, investors may find it difficult to work with the manager as well.

Investor Relations

The investor relations team is responsible for handling issues related to setting up meetings, handling withdrawal requests and checks, and conveying performance information. The CEO and the fund manager should not be part of this team so that these individuals can focus their time and energy on generating investment returns.

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Business Continuity

Business continuity planning gives the fund manager a course of action for continuing to manage the fund in the event that a disaster shuts down a fund's trading and operations. Most continuity plans include leasing space at a disaster recovery site in another city and having a backup trading desk with duplicate computer systems. In order for a disaster plan to be effective, the fund manager should have systems and procedures in place that are understood by all of the fund's employees.

Performance Review Phase of Due Diligence

LO 31.6: Demonstrate knowledge of the procedure for conducting a performance review of a fund manager in the due diligence process.

For example:

- **Describe the behavioral biases that can interfere with performance analysis.**
- **Identify and discuss three important questions to ask regarding all assets controlled by the fund manager.**
- **Discuss the analysis of drawdowns.**
- **Identify and discuss the five issues related to the use of past data to predict future performance.**
- **Describe how the analysis of returns can be impacted by the investment horizon.**
- **Discuss issues related to subscriptions, redemptions, and volatility of assets under management.**
- **Describe considerations in the review of the asset manager's process for pricing securities in a portfolio.**

Behavioral Biases

Behavioral biases have the potential to interfere with performance analysis by influencing the interpretation of quantitative and qualitative information. Most investors have a **bias blind spot**, which causes them to underestimate the influence of behavioral biases on their own behavior. **Confirmation bias** causes investors to interpret data in a manner that supports their beliefs. Performance reviews should follow qualitative due diligence to prevent undue influence from positive historical performance. In addition, investors must take care not to engage in **herd behavior** by inappropriately allowing their due diligence conclusions to conform to their peers.

Performance Questions

When conducting the **performance review phase**, there are three relevant questions that potential investors should ask:

1. *How long has the fund manager been actively managing a fund?* The attrition rate in the fund industry is high, with many fund managers going out of business after only two to three years. As a result, if a manager has run a fund for five years or more, the individual qualifies as a long-term manager in the fund industry.

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2. *Have performance results for the fund shown persistency over time?* Studies show that most funds do not exhibit long-term performance persistence. Nonetheless, the investor should have evidence that the manager has been successful in the past and that the success is the result of manager skill, which indicates the potential for success in the future. If the fund's performance results include an information ratio, the manager should have an average information ratio greater than 1.0 to be considered successful. In addition, pricing models, valuation models, and audit records should be carefully scrutinized to ensure that stated performance mirrors actual performance.

3. *Are the performance results the same or different for each fund the manager manages?* If a manager runs more than one fund, the strategy should be documented for each fund. For funds with a similar style, the investor needs to determine the manager's **trade allocation** procedure. This procedure details how newly acquired positions are distributed among the various funds.

Drawdowns

Drawdowns are declines in the net asset value of a fund. Drawdowns are not unique to the world of alternative investments but are a major concern because they represent a loss of the investor's capital.

Drawdowns in long-only investments, such as mutual funds, are generally caused by a decline in the value of a market index because the primary risk associated with most long-only funds is market risk. Therefore, it naturally follows that a decline in the value of a market will cause a decline in the value of a fund.

Most funds, however, seek to hedge market risk exposure and instead rely on a manager's skill to generate returns. In theory, if results depend totally on a manager's skill, a truly skillful manager should not have drawdowns. However, funds with positive or negative exposure to the market can reasonably be expected to have returns that are partially correlated to the market. If a drawdown in a fund occurs, the investor should measure how much the temporary loss in skill cost the fund and how long it took the manager to recover the loss. The manager should also explain the reason for the temporary loss of skill.

Return Data

Analysts must use caution when using historical return data in due diligence. There are five key issues with utilizing historical return data in the performance review process.

1. *Accuracy*. **Expectation bias** (or *confirmation bias*) refers to the tendency to overemphasize information that is consistent with prior beliefs. Managers may inadvertently report flawed data that is consistent with prior performance of their fund.

2. *Representativeness*. Managers may fail to report unfavorable performance or poorly performing investments to maintain their image.

3. *Stationarity*. Historical performance may not be related to expected future performance. Positive returns may attract competition and dilute future results.

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4. *Gaming.* **Gaming** refers to investment actions undertaken to improve performance measures (e.g., smoother returns and lower volatility) rather than benefit investors. For example, measures such as the Sharpe ratio can be manipulated by shifting gains and losses to beneficial time periods to reduce volatility.

5. *Appropriateness.* Performance measures that do not account for non-normal returns, smoothed prices, and non-linear payoffs may be inappropriate for alternative investments.

Analysis of Returns and Investment Horizon

Investors must also be concerned with issues related to correlation and volatility measurements as short-term measurements can fail to accurately convey the long-term risk of a fund.

- *Correlation.* Correlation and autocorrelation may change over time. Correlation may increase during periods of market stress. Investors must account for this possibility to properly measure risk.
- *Volatility.* Risk may be measured using **annual volatility**, whereby a short-term volatility (e.g., **daily volatility** or weekly volatility) is mathematically annualized by multiplying the short-term volatility by the square root of the number of time periods in a year, assuming zero autocorrelation. This procedure may significantly understate risk over the long term if returns exhibit autocorrelation. Significant autocorrelation can cause large directional moves during market stress. Such moves may result in large losses to investors who, because of their reliance on annualized volatility, are unaware of the inherent risk of their investments.

Subscriptions and Redemptions

Subscriptions (i.e., new capital from investors) are necessary to operate a fund. However, increasing subscription levels may hinder performance due to the time lag between receiving cash and investing in less liquid strategies, and due to potentially unequal transaction cost distribution (i.e., transaction costs resulting from investing new subscriptions are borne not just by new investors, but by existing investors as well). New subscriptions may also force managers to invest in inferior ideas in order to deploy capital.

Redemptions (i.e., *withdrawals)* by investors can have a harmful effect on fund performance. If a fund manager does not have cash on hand to meet an investor's request to withdraw funds, the fund manager must sell securities in order to meet the request. This means that the fund will incur transaction costs, which are effectively paid by all investors in the fund. Selling less liquid securities will result in higher transaction costs. For a fund that invests in thinly traded securities, such as convertible bonds, the amount of transaction costs can be substantial.

Another problem related to withdrawals is a change in the fund asset allocation. If sales to raise cash are not made on a proportionate basis, weightings of securities within the fund will differ from the manager's original intention, potentially resulting in missed investment opportunities.

Portfolio Pricing

Portfolio valuation is a key issue in determining fees owed to fund managers, measuring performance, and managing operational risk. Due to the implied call option in

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performance-based fees, managers have financial incentive to continue operating. Thus, managers have an incentive to delay recognizing losses (in hopes of a recovery) in order to preserve compensation and to artificially lower volatility by smoothing returns.

The conflict of interest between managers and investors in pricing the portfolio can be mitigated through external pricing services. This is particularly important for alternative asset portfolios, which often contain difficult-to-price illiquid assets. However, even external valuation may generate incorrect values during periods of market stress. Alternatively, fund managers may use a **mark-to-model** process in which they use an internal valuation model to price assets. Internal valuation models may be subjective and unreliable.

Publicly traded assets are less difficult to price, but still require scrutiny. Securities with wide bid-ask spreads should be conservatively priced at whichever generates a lower portfolio value (i.e., bid price for long positions and ask price for short positions). Alternatively, securities can be priced at the midpoint between the bid and ask prices. These measures do not guarantee accurate pricing, however. Fund managers may still attempt to manipulate prices of thinly traded securities by placing large buy (sell) orders at the end of the trading day to support long (short) position values. This practice is known as *painting the tape* and is a form of illegal market manipulation.

In the United States, the Financial Accounting Standards Board defines three levels of assets in assessing fair asset values under generally accepted accounting principles:

- **Level 1 assets:** asset values determined by unadjusted market price quotes from an exchange or actively traded market of identical assets.
- **Level 2 assets:** asset values based on non-active market price quotes, market prices of similar assets, or based on a pricing model.
- **Level 3 assets:** asset values based on non-observable inputs using subjective or inexact techniques.

No matter which valuation methods are used, investors must carefully document the procedures before investing. In particular, valuation procedures for difficult-to-value assets must be supported by four elements.

1. A qualified, impartial party should conduct the valuation.

2. The valuation methodology must be documented and justified.

3. Valuation assumptions and inputs must be documented.

4. An independent review by a qualified party should be performed.

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Risk Review Phase of Due Diligence

LO 31.7: Demonstrate knowledge of the procedure for conducting a portfolio risk review of a fund manager in the due diligence process.

For example:
- **Identify and discuss three important risk management questions.**
- **Describe and apply the role of leverage in determining the total risk of a fund.**
- **Discuss the role of the chief risk officer (CRO).**

The three relevant questions to complete the **risk review phase** of the due diligence analysis include the following:

1. *What is the risk level and risk types of the fund strategy?* The investors should understand the riskiness of the fund manager's strategy. Does the fund manager use portfolio concentration, illiquid securities, or leverage? The investor should ensure that the fund strategy is consistent with his level of risk aversion.

2. *What risks are measured, monitored, and managed by the fund manager?* It is important to know what risks the manager thinks are important or unimportant with regard to the fund strategy. For example, an investor in a long/short fund will want to know if the manager focuses on the gross long and short positions or only on the net long exposure of the fund.

3. *How does the fund manager measure, monitor, and manage risk?* Risk measures take many different forms, including standard deviation, semi-variance, value at risk, and dollar loss. A potential investor should document how a manager defines and measures risk. **Risk management** is the process of identifying and evaluating risks and putting processes in place to mitigate risk exposure. Knowing what steps a manager takes to manage the risk of the fund is critical. Does a manager have limits on the percentage for any one security in the portfolio? Is there an upper limit for volatility? Does the manager use a risk budgeting process? A potential investor should document actions a fund manager takes to control risk. In addition, the investor should confirm that the risk officer of the fund is not the chief investment officer to ensure that fund risks are properly monitored.

Active Risk, Short Volatility Risk, Counterparty Risk

Active risk, also known as *tracking error,* is defined as the standard deviation of the difference between portfolio returns and the returns of a benchmark (i.e., the standard deviation of excess returns). It is used to measure the risk in an investment portfolio resulting from active management decisions made by the portfolio manager.

Short volatility risk occurs when a manager has a short position in a call or put option. When the manager sells the option, he keeps the premium received, which adds to the return of the fund if the option expires unexercised. However, if volatility increases, there is a greater risk that the short option position will be exercised against the fund manager, exposing the fund to potentially unlimited losses.

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Counterparty risk refers to the risk that the person on the other side of a derivative contract will default on the agreement. For exchange-traded futures contracts, counterparty risk is not a concern because the futures exchange guarantees both sides of the contract. However, many funds transact in privately negotiated over-the-counter (OTC) agreements. With an OTC contract, a fund manager can only rely on good faith that the other party will fulfill its obligations under the terms of the contract.

Leverage and Total Fund Risk

Leverage (L) can be defined as the ratio of assets to equity as follows:

$$L = A/E$$

where:
L = leverage ratio
A = value of assets
E = value of equity

A fund with a leverage ratio of *L* has short-run returns with volatility of *L* times the asset volatility. However, when compared to a fund without leverage, the probability of a given percentage loss is greater than *L* times the probability of the same loss for the unleveraged fund. For an ***N*-sigma** event (i.e., an event that is *N* standard deviations from the expected return), the probability of experiencing a loss is much higher for a leveraged fund than for an unleveraged one. In stressed markets, double digit sigma events may occur. Therefore, investors must carefully assess the leverage of a fund before investing.

Example: Leverage and Losses

A fund manager currently does not utilize any leverage. She is considering using 2-to-1 leverage to improve absolute returns. Assume a normal return distribution, a daily standard deviation of 1%, a 15.9% probability of a 1-sigma event, and a 2.3% probability of a 2-sigma event. **Determine** the increased likelihood of the leveraged fund losing 2% relative to the unleveraged fund.

Answer:

A 2% loss is a 2-sigma event for the unleveraged fund. However, with a leverage ratio of 2:1, a 1% loss in asset value (i.e., a 1-sigma event) equals a 2% loss in the drop in the value of the fund. The leveraged fund is nearly seven times (15.9%/2.3% = 6.91) more likely to experience a daily loss of 2% relative to the unleveraged fund.

Leverage limits are an effort to limit risk by placing an upper bound on the amount of leverage a fund manager can use. Despite their benefits for risk management, most leverage limits still give a fund manager a great deal of flexibility to use borrowed funds to magnify investment returns, and some fund managers refuse to have a leverage limit at all.

Because leverage can magnify returns on both the upside and the downside, it is important for a potential investor to understand how a manager uses leverage. The investor should document both the highest amount of leverage ever used for a fund as well as the average amount of leverage used under typical conditions.

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Chief Risk Officer

The **chief risk officer** (CRO) is responsible for the measurement, monitoring, and management of a fund's risk exposures. The best practice is to ensure the CRO is separate from the chief investment officer (CIO) so that a conflict of interest between investment decisions and risk management decisions does not occur. Smaller funds may combine the CRO and CFO positions, which does not present a conflict of interest. The CRO is responsible for setting leverage limits and position limits (i.e., limits on exposure to any single investment) if such limits are not defined in the fund partnership agreement.

Legal Review Phase of Due Diligence

LO 31.8: Demonstrate knowledge of the procedure for conducting a legal review of a fund manager in the due diligence process.

For example:
- **Discuss considerations in the review of the fund structure.**
- **Discuss considerations in the review of the fund fees.**
- **Discuss considerations in the review of the lockup and redemption provisions, including gates and hard and soft lockup periods.**
- **Discuss considerations in the review of the subscription amount.**
- **Discuss the role of the advisory committee.**

The **legal review phase** looks at rules that a fund has in place that must be followed by investors. These rules include fees paid to the fund manager, lockup periods, and minimum subscription amounts.

Fund Structure

Most funds are set up with a **limited partnership structure**. Each investor becomes a limited partner in the fund by purchasing partnership units that entitle the investor to a proportionate share of the fund's returns. The fund manager acts as the general partner and invests capital in the fund alongside the limited partners. Having a portion of capital invested in the fund aligns a manager's interests with those of investors.

The fact that investors are limited partners means that investors risk only the capital they have invested in the fund. In other words, the amount the investor has put into the fund can fall to zero, but the investor cannot lose any more than that. This is known as the **limited liability shield** (or **financial firewall**) that protects limited partners' personal assets. The general partner bears any surplus risk from the fund's investment strategies.

In a **separate account structure**, the capital from each investor is tracked as a separate account. Compared to limited partnerships, separate accounts lack the advantages of having limited downside risk and the alignment of interests that occurs when investing alongside a fund manager. However, there are two primary advantages that result from a separate account:

- *Withdrawals from other investors do not negatively impact performance.* If a withdrawal is made from a separate account, all transaction costs will be a result of selling the investor's own securities.
- *Easier performance reporting.* Because the entire account belongs to the investor, all gains and losses also belong to the investor, and there is no need to divide securities or their

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associated returns on a proportionate basis. In addition, this improved transparency reduces the likelihood of fraud.

Fund Fees

Investors must document fee structures, including how these structures are earned and when they are paid. Management fees are usually paid quarterly, but may also be paid semi-annually or annually.

Incentive fee is another name for the profit-sharing fee in a fund fee schedule. An incentive fee gives the fund manager an incentive to earn profits for investors by allowing the manager to share in a percentage of those profits.

Clawbacks allow investors in a fund to take back incentive fees previously received by the fund manager. A clawback arrangement will typically apply when a fund manager does not earn a rate of return above some hurdle rate over a reasonable period of time. For example, over a three-year period, if a fund manager only has an annual return of 2%, but the fund manager's hurdle rate is 5%, a clawback provision would allow investors to take back any performance fees the fund manager previously received. In practice, clawbacks are rare in the hedge fund world, but are common in private equity.

Lockup Periods and Redemption Provisions

A **lockup period** refers to a set period of time that an investor's capital must remain with a fund. Typical lockup periods are up to three years for hedge funds and up to 10 years for private equity funds. During the lockup period, the investor cannot request any withdrawals. There are two types of lockup periods.

1. **Hard lockup periods** do not allow the investor to withdraw capital for the duration of the lockup period.

2. **Soft lockup periods** allow the investor to withdraw capital during the lockup period, but charge a 1–5% redemption fee. The redemption fee discourages withdrawals and helps cover the fund manager's cost to liquidate portfolio assets to meet the early redemption.

The obvious disadvantage to a fund lockup period is that the investor loses access to his money for a set period of time. However, lockup periods do have advantages for investors:

- *The fund manager has time to implement the fund's investment strategy.* During the lockup period, the manager can focus entirely on implementing the fund's strategy without having to worry about raising or keeping cash to cover fund redemptions.
- *The problem of transaction costs caused by withdrawals is temporarily eliminated.* Investors can know with confidence that the performance of their investment will not be reduced as a result of transaction costs incurred from other fund investors making withdrawals.

Redemption (i.e., withdrawal) terms are specified in the subscription agreement and generally allow quarterly or semiannual withdrawals, which may be subject to a notice period. A **notice period** refers to a certain period of advance warning for the fund manager that an investor wants to withdraw funds. Typical notice periods require an investor to alert a fund manager anywhere from 30 to 90 days in advance that the investor wants to make a redemption. This advance notice gives the fund manager time to reposition the fund's portfolio to raise cash for the redemption request. Investors must carefully assess whether the redemption provisions in the subscription agreement match the liquidity of the portfolio assets in the fund and whether redemptions are subject to a **gate**, which is a

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provision that limits redemptions after the lockup period has expired. Gates are often used during market stress or periods of high investor withdrawals.

Subscription Amounts

Subscription amounts refer to the amount of money an individual investor invests in a fund. All funds have a *minimum subscription amount*. Typically, the minimum subscription amount is high ($100,000 and above) in order to give the fund manager adequate capital to implement the fund's investment strategy and ensure that only sophisticated investors with large net worth invest in the fund.

While all funds have minimum subscription amounts, most funds also have *maximum subscription amounts*. Setting an upper limit on the amount a single investor can invest in a fund prevents one investor from having too large of a position compared to other investors in the fund. In addition, some funds may have capacity constraints with regard to assets under management. In this case, setting a maximum subscription amount can help manage cash flows into the fund.

Advisory Committee

Advisory committees are small groups of investors and fund representatives who advise the fund manager on valuation practices, accepting new investor subscriptions, and overall fund capacity. Advisory committees are more common to private equity funds than hedge funds.

Reference Review Phase of Due Diligence

LO 31.9: Demonstrate knowledge of the procedure for conducting reference checks on service providers and other fund investors.

For example:
- **Discuss the process of conducting reference checks on service providers.**
- **Identify key questions to ask when conducting reference checks on other investors.**

Potential sources of due diligence reference checks include outside service providers and existing clients:

- *Outside service providers* include the outside auditor, the fund's legal counsel, and the fund's prime broker.
- *Existing clients* are in the best position to tell a potential investor about the service received and level of satisfaction with the fund manager. Fund managers will generally supply a limited list of investors to contact.

Reference Checking Questions

Relevant due diligence questions to be asked to outside providers include:

- *Outside Auditor:*
  - During the last completed audit, was an unqualified opinion offered?
  - If not, what issues did the audit uncover?
- *Legal Counsel:*
  - Have any civil, criminal, or regulatory actions been filed against the fund manager?
  - What regulatory registrations are required for the fund manager and have they been maintained?

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- *Prime Broker:*
  - What is the frequency and magnitude of margin calls?
  - Did the fund have any difficulty providing the capital needed for margin calls?
  - Does the reported investment value of the fund match your records?

While these questions may provide insightful information, investors should understand that information provided by outside service providers may be biased as the providers benefit from the success and longevity of the fund, and may face negative consequences from providing unfavorable information about the fund.

Relevant due diligence questions to be asked to existing clients include:

- Have financial reports been produced in a timely manner?
- Are financial reports easy to read and understand?
- Is the fund manager responsive to questions?
- Has the fund manager consistently maintained the fund's investment process?
- Do you have any concerns about the fund's performance?
- Would you invest more money with the fund manager?

All of these questions should help potential investors gain an idea of the service they are likely to receive and any concerns that existing clients have about the fund manager. Investors must keep in mind, however, that the investor sample provided by the manager will be biased. A network of industry professionals may provide access to other current and former investors who can provide additional unbiased information.

Operational Risk

LO 31.10: Demonstrate knowledge of the procedure for measuring operational risk.

For example:
- **Discuss the role of the omega score in measuring operational risk.**
- **Discuss the cost of fund manager due diligence.**

Operational risk refers to the uncertainty of economic outcomes resulting from imperfect implementation of a fund's strategy. Operational due diligence is therefore an important component of the overall due diligence process.

An **omega-score**, as proposed by Brown, Goetzmann, Liang, and Schwartz (2008), predicts future operational risk using the fund's age, size, fees, volatility, and historical performance. Brown et al. find that a fund's omega score can predict whether it is likely to fail. Brown et al. also find that funds with high operational risk also have high financial risk. Thus, the relationship between these two risks is also a contributing factor to fund failure.

Due Diligence Costs

We have covered a large amount of information regarding due diligence. Clearly the due diligence process is time consuming and expensive. A comprehensive due diligence process for a single fund may take anywhere from 75 to 100 hours and may cost in excess of $50,000. While the time and costs are considerable, the process will likely yield alpha for investors.

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Key Concepts

LO 31.1

Due diligence is a disciplined approach for finding the best possible fund manager. The due diligence process consists of seven phases:

1. Structural review.
2. Strategic review.
3. Administrative review.
4. Performance review.
5. Risk review.
6. Legal review.
7. Reference review.

LO 31.2

Three fundamental questions to ask in order to understand a fund's investment program:

1. What is the fund manager's investment objective?
2. What is the fund manager's investment process?
3. What is the fund manager's competitive advantage?

Three essential questions for understanding a fund manager's investment objective:

1. What is the fund manager's investment universe?
2. What is the general investment strategy of the fund?
3. Does the fund manager have a benchmark, and if so, what is it?

A black box investment process uses a quantitative computer algorithm preprogrammed by the fund manager to make investment decisions.

Investment process risk is an unquantifiable, idiosyncratic, manager-specific risk that arises from the operations of a firm.

Hedge funds gain a competitive advantage through their ability to either filter or gather information.

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LO 31.3

The structural review phase of the due diligence process allows an investor to define how the fund is organized as a business entity.

A master trust structure is used to invest a fund's assets in feeder funds in order to accommodate the various tax domiciles of the fund's domestic and foreign investors. A master trust structure has no direct tax consequences, which allows any tax liability associated with investing in a fund to fall under the tax code of each investor's home country.

To identify how a fund is organized, an investor should ask the following questions:

- Where is the fund manager located?
- May I see an organization chart of key personnel?
- What is the educational background and prior experience of the firm's principals?
- How did the manager learn to short stocks?

The CFO of a fund is responsible for reporting the fund manager's performance results to investors.

An investor needs to know who owns the fund manager in order to ensure that contracts are being signed with the right key people and that interests are aligned effectively between the fund manager and its employees.

Investors should verify and document all of the fund manager's regulatory registrations.

Important outside service providers to fund managers are outside auditors, prime brokers, and legal counsel. Prime brokers are responsible for executing trades, lending securities to sell short, and providing the means for the fund to leverage its positions.

LO 31.4

A fund's investment style, the target markets a manager invests in, and the type of securities a manager invests in should be documented in order to fully understand the manager's investment strategy.

A short volatility strategy involves taking short positions in call or put options so that rising volatility in the price of the underlying security exposes the investor to the risk that the options could be exercised against the investor.

Passive benchmarks are difficult to use for evaluating fund performance because of the following:

- Passive benchmarks are ineffective for measuring the level of a manager's skill.
- Hedge fund strategies such as a long/short strategy cannot be captured by a long-only benchmark.
- Concentrated portfolios look much different than broad-based security benchmarks.

A fund style index uses the aggregate performance of a group of funds that match the style of target fund as a benchmark.

Hurdle rates are appropriate measures of performance for absolute return funds whose returns do not relate to the performance of any one sector or market.

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The process used for idea generation is a key component of a fund's competitive advantage and is reflective of the fund manager's skill.

A portfolio snapshot lets a potential investor see exactly what positions a manager is currently holding in the fund portfolio and gives insights into the manager's strategy.

Capacity refers to the amount of assets under management a fund manager can handle and still implement the fund's investment strategy effectively.

LO 31.5

A review of civil, criminal, and regulatory actions is an important part of due diligence because (1) it provides an insight into the manager's character, and (2) legal and regulatory issues are time consuming.

Employee turnover leads to the following issues: (1) fund manager is forced to spend time and resources finding and training new employees, (2) former employees may have been responsible for the fund's competitive advantage, and (3) high levels of turnover may reflect a volatile work environment.

The investor relations team is the investor's link for handling issues related to setting up meetings, handling withdrawal requests, processing checks, and conveying performance information.

Business continuity planning gives the fund manager a course of action for continuing to manage the fund in the event that a disaster shuts down a fund's trading and operations.

LO 31.6

Behavioral biases have the potential to interfere with performance analysis. A bias blind spot causes investors to underestimate the influence of behavioral biases on their own behavior. Confirmation bias causes investors to interpret data in a manner that supports their beliefs.

Three relevant questions to ask when reviewing a fund manager's performance:

1. How long has the fund manager been actively managing a fund?

2. Have performance results of the fund shown persistency over time?

3. Are performance results the same or different for each fund the manager manages?

Drawdown refers to a decline in the NAV of a fund. Depending on the fund's portfolio, drawdowns may be attributed to lack of skill or market declines.

Analysts must use caution when using historical return data in due diligence. There are five key issues with utilizing historical return data in the performance review process: accuracy, representativeness, stationarity, gaming, and appropriateness.

Analysts who use short-term correlation and volatility measurements to determine their long-term equivalents should make sure to consider the implications of autocorrelation.

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Increasing subscription levels may hinder performance due to the time lag between receiving cash and investing in less liquid strategies, and due to potentially unequal transaction cost distribution. Redemptions (i.e., withdrawals) can have a harmful effect on fund performance by triggering transaction costs and skewing the asset allocation of the hedge fund portfolio.

Due to the implied call option in performance-based fees, managers have financial incentive to delay recognizing losses. The conflict of interest between managers and investors in pricing the portfolio can be mitigated through external pricing services. Publicly traded assets should be conservatively priced to generate the lowest portfolio value or using the midpoint between the bid and ask prices.

LO 31.7

Relevant questions for the risk review phase of due diligence analysis:

1. What is the risk level and risk types of the fund strategy?

2. What risks are measured, monitored, and managed by the fund manager?

3. How does the fund manager measure, monitor, and manage risk?

Active risk is defined as the standard deviation of the difference between portfolio returns and the returns of a benchmark.

Short volatility risk refers to the risk that rising volatility in the prices of underlying securities could cause short call or put options to be exercised against the fund manager.

Counterparty risk is the risk that the person on the other side of a derivative transaction will default on the agreement.

Leverage limits are an effort to limit risk by placing an upper bound on the amount of leverage a fund manager can use.

The chief risk officer (CRO) is responsible for the measurement, monitoring, and management of a fund's risk exposures. Best practice is to ensure the CRO is separate from the chief investment officer (CIO).

LO 31.8

The limited partnership structure of a fund requires the manager to invest alongside investors, thus aligning manager and investor interests. Limited partners are at risk only to the extent of capital they have invested in the fund.

Separate accounts lack the advantages of the limited partnership structure but serve to eliminate concerns related to withdrawals and proportionate gain/loss reporting.

An incentive fee gives the fund manager an incentive to earn profits for investors by allowing the manager to share in a percentage of those profits.

Clawbacks allow investors in a fund to take back incentive fees previously received by the fund manager.

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A lockup period refers to a set period of time that an investor's funds must remain with a fund. Hard lockup periods do not allow the investor to withdraw capital. Soft lockup periods allow the investor to withdraw capital but charge a 1–5% redemption fee.

Having a lockup period is advantageous to investors because it: (1) gives the fund manager time to implement the investment strategy without worrying about redemptions and (2) temporarily eliminates the problem of transaction costs caused by withdrawals.

Redemption terms are specified in the subscription agreement and generally allow quarterly or semiannual withdrawals, which may be subject to a notice period. Typical notice periods require an investor to alert a fund manager anywhere from 30 to 90 days in advance that the investor wants to make a redemption. Redemptions may also be subject to a gate, which limits redemptions after the lockup period has expired.

High minimum subscription amounts give the fund manager adequate capital to implement the fund's investment strategy and ensure that only sophisticated investors with a large net worth invest in the fund.

Maximum subscription amounts prevent one investor from having too large of a position in the fund and can help manage capacity constraints with regard to assets under management.

Advisory committees are small groups of investors and fund representatives who advise the fund manager on valuation practices, accepting new investor subscriptions, and overall fund capacity.

LO 31.9

Potential sources of due diligence reference checks include outside service providers and existing clients. Outside service providers may be reluctant to reveal unfavorable information about fund due to potential negative repercussions.

Asking questions to existing fund clients gives an idea of the manager's quality of services and can uncover any issues the clients may have that cause dissatisfaction with the fund manager.

LO 31.10

Operational risk refers to the uncertainty of economic outcomes resulting from imperfect implementation of a fund's strategy. An omega-score predicts future operational risk using the fund's age, size, fees, volatility, and historical performance. Funds with high operational risk also tend to have high financial risk and high failure rates.

A comprehensive due diligence process for a single fund may take anywhere from 75 to 100 hours and may cost in excess of $50,000, but it will likely lead to alpha for the investor.

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Concept Checkers

1. Which of the following situations is *most likely* indicative of a black box investment process?
   A. A manager uses P/E analysis to narrow herself to three firms to consider investing in and then meets with the manager of each firm.
   B. A manager returns from lunch and checks his computer to see if his computer program added any new positions to his fund.
   C. Once a manager selects which security to purchase, she enters the price of the security and the percentage of the portfolio into a spreadsheet to find out how many shares to purchase.
   D. A manager uses charts of historical security price patterns in order to make current investment decisions.

2. Which of the following statements regarding master trusts is *most correct*? Master trusts:
   A. are effective vehicles for tax evasion.
   B. have adverse tax consequences for fund investors.
   C. allow a fund manager to invest both on-shore and off-shore funds with a consistent investment strategy.
   D. limit the potential losses of fund investors to the amount of capital invested in the fund.

3. From the perspective of a relationship with an investor, the primary role of a fund's CFO is to:
   A. handle any issues related to withdrawals from the fund.
   B. make day-to-day investment decisions in the fund.
   C. execute trades as directed by the fund manager.
   D. report the performance numbers of the fund.

4. Matthew Tice, a hedge fund manager, states, "A passive benchmark is not the best way to assess my hedge fund's performance." Which of the following is the *least appropriate* justification for his statement?
   A. Performance measures are not necessary for absolute return fund managers.
   B. The non-linear payoffs that result from the use of derivative securities cannot be captured by a passive benchmark.
   C. Concentrated portfolios are too distinct from a broad-based securities benchmark.
   D. A market-neutral portfolio strategy cannot be captured by a long-only benchmark.

5. Which of the following pieces of information is *least likely* to be provided by a portfolio snapshot?
   A. Position of the portfolio relative to current market conditions.
   B. Number of securities held by the fund.
   C. Amount of cash held by the fund.
   D. Amount of excess return achieved by the fund manager.

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6. Which of the following *best* describes why withdrawals can be detrimental to the performance of a fund?
   A. Transaction costs.
   B. Capacity.
   C. Active risk.
   D. Counterparty risk.

7. A loss of investor capital in a fund is called:
   A. turnover.
   B. drawdown.
   C. clawback.
   D. lockup.

8. Which of the following investment strategies is *most likely* to have the greatest short volatility risk?
   A. Covered call position.
   B. Short position in an equity index futures contract that expires in less than one month.
   C. A dollar-neutral position in two stocks in the discount retailer sector.
   D. Short put option and a short call option on the same underlying stock.

9. Which of the following statements concerning maximum subscription amounts is *most correct*? Maximum subscription amounts:
   A. ensure that only sophisticated investors invest in a fund.
   B. keep a single investor from having too large of a position in a fund.
   C. give the fund adequate capital to implement a fund's investment strategy.
   D. keep a fund manager from earning excessive incentive fees.

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Concept Checker Answers

1. **B** A black box investment process uses a quantitative computer algorithm preprogrammed by the fund manager to make investment decisions. The key point here is that the black box ends up becoming the investment process. Once the manager programs the algorithm, the computer makes the relevant investment decisions based on the appropriate criteria. (LO 31.2)

2. **C** The purpose of a master trust is tax neutrality, not tax evasion. A master trust structure is used to invest fund assets in a way that accommodates the tax domiciles of a fund's domestic and foreign investors by allowing a fund manager to invest both on-shore and off-shore feeder funds with a consistent investment strategy. Note that a limited partnership structure limits the potential losses of fund investors to the amount of capital invested in the fund and that a separate account structure eliminates the concern that withdrawals from other investors will have harmful effects on the performance of a fund. (LO 31.3)

3. **D** Once an investor makes an investment in a fund, the CFO is responsible for reporting the fund's performance results. (LO 31.3)

4. **A** Benchmarking is a problem for fund managers because (1) an unmanaged passive benchmark is ineffective for measuring a skill-based investment process, (2) many fund strategies cannot be captured by a long-only benchmark, and (3) concentrated portfolios are often too different to create using a broad-based benchmark applicable. Despite the problems with benchmarking, the investor needs to establish some performance standard for the fund manager. In the case of an absolute return manager, the hurdle rate—or return a manager should exceed over a certain time period—is an appropriate measure of performance. (LO 31.4)

5. **D** A portfolio snapshot is a look at the current holdings in a manager's portfolio. A snapshot will let an investor see the net market exposure of a fund, the number of holdings, and how much cash the fund holds, and it will give an idea of how the portfolio is positioned relative to current market conditions. Looking at a fund's holdings, however, will not help the investor determine a fund's excess return. (LO 31.4)

6. **A** If a fund manager does not have cash on hand to meet an investor's request to withdraw funds, the fund manager must sell securities to meet the request. Selling securities means that the fund must incur transaction costs, which are effectively paid by all of the investors in the fund. Large transaction costs related to raising cash for withdrawals can have a detrimental impact on fund performance. (LO 31.6)

7. **B** Drawdowns are a decline in the net asset value of a fund. Drawdowns represent a loss of investor capital. (LO 31.6)

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8. **D** A short put option plus a short call option on the same security is a prime example of a short volatility strategy where a rise in volatility of the underlying security would cause losses for the investor. Short volatility risk comes into play when an investor sells a call or put option on a security. The investor will keep the premium received if the price of the underlying security does not move, but she is likely to have the option exercised if volatility of the underlying stock price increases. In the case where both a call and put option are sold on the same stock (called a short straddle), any dramatic moves in price (up or down) will cause one of the options to be exercised and could result in potentially unlimited losses for the investor. (LO 31.7)

9. **B** Maximum subscription amounts set an upper dollar limit that any one investor can invest in the fund. Having a maximum subscription amount prevents any one investor from having too large of a position in a fund and can help manage flows into a fund that has capacity issues. Note that high minimum subscription amounts help ensure that only sophisticated investors invest in a fund and help the manager to have adequate capacity to implement his investment strategy. (LO 31.8)

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The following is a review of the Risk Management and Portfolio Management principles designed to address the learning objectives set forth by the CAIA Association®.

Portfolio Management, Alpha, and Beta

Topic 7.4

Exam Focus

This topic review focuses on the role of alpha and beta in portfolio management. Alpha is the return in excess of the compensation for risk. Beta is a measure of the systematic risk of the security or portfolio relative to the market as a whole. Understand the potential errors in estimating alpha and beta. Portable alpha is a critical concept in this reading. Understand the concept of separating alpha and beta and examples of how a manager can use the concept of portable alpha by taking long and short positions in securities and/or derivative contracts. Be able to calculate the number of futures contracts required to transfer beta risk. Also, be able to explain the difference between the traditional asset allocation approach and the new investment model, focusing on strategic asset allocation, tactical asset allocation, and active versus passive management. Finally, be able to explain the notion that alpha is a zero-sum game.

Smart Beta

LO 32.1: Demonstrate knowledge of smart beta strategies.

For example:

- **Recognize the distinguishing characteristics of smart beta strategies from active alpha-based strategies.**
- **Describe the objectives of smart beta strategies.**
- **Discuss how smart beta strategies can be used in portfolio management.**

Passive index strategies and strategies that pursue alpha are often viewed on opposite ends of the investment spectrum. In recent years, the hybrid strategy of smart beta has increased in prominence. **Smart beta** strategies use rules-based portfolio weights that differ from market capitalization weights in an attempt to deliver improved risk and returns. Often, smart beta strategies try to capture anomalies that have been identified in empirical research. For, example, a firm may construct a small-cap, value strategy with stocks that have low volatility and price momentum because of the empirical evidence of these effects. Smart beta strategies can be used for both traditional and alternative investments.

Characteristics of smart beta strategies include all of the following:

- Attempt to capture a systemic risk premium.
- Utilize rules that rely on security characteristics (e.g., small-capitalization).
- Have portfolio weights that differ from market capitalization weights.
- Maintain broad portfolios.

Errors in Estimating Ex Ante Alpha

LO 32.2: Demonstrate knowledge of factors involved in the estimation of alpha and beta.

For example:
- **Understand the challenges of estimating alpha and beta.**

Alpha is a risk-adjusted measure of return, often used to assess the performance of active managers. It is the return in excess of the compensation for risk. Alpha, like beta, is unobservable and must be estimated using historical data. This gives rise to potential errors in estimation.

For example, a hedge fund strategy that involves writing options each month has an expected return based on a forecast of how often the options will be exercised and how often they will expire unexercised. If, for example, the hedge fund manager assumes the options will be exercised in two months and will expire unexercised in the remaining ten months, he can estimate an expected return for the strategy. However, actual returns depend on actual outcomes. In some years, zero options may be exercised, leading to a higher return than expected. In other years, options may be exercised in several months, leading to lower returns than expected. Thus, there will likely be errors in estimating the strategy's ex ante alpha.

Errors in Estimating Ex Ante Beta

Beta is a measure of the systematic risk of a security or portfolio relative to the market as a whole. It too is unobservable and must be estimated using historical data. Beta is typically estimated by regressing the returns of a security or strategy on the returns of a market index, such as the S&P 500. The slope coefficient of the regression is the security or strategy's beta. Idiosyncratic returns are assumed to be normally distributed.

To continue the example above, assume the option writing strategy has no systematic risk. In this simplified example, the returns on the strategy are unrelated to major market movements each month. However, if the months in which the options are exercised (and thus the strategy experiences a loss) happen to be months in which market indices rise or fall substantially, the strategy is going to appear to have systematic risk (i.e., a statistically significant beta). The true correlation between the returns on the strategy and market returns is zero, but the faulty assumption of normally distributed idiosyncratic returns leads statistical tests to indicate significant correlation.

A second issue concerns the signs of the reported beta(s). The signs will be driven by whether the market increases or decreases in the months in which the strategy incurs large losses; in this example, in months when options are exercised. If the market increases substantially in a month when options are exercised, the beta will be negative. It will be positive if the market falls in a month when options are exercised. However, both the positive and negative signs are random given that the strategy is assumed to have no systematic risk. The true beta should actually be zero.

Estimating Dynamic Alphas and Betas

True alphas and betas are not static; they change through time. Consider the option writing strategy discussed in the previous section. Call writing has negative beta exposure while put

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writing has positive beta exposure. Straddle writing has virtually no systematic risk. The beta exposures for the strategies are dynamic. Using historical data to estimate dynamic alphas and betas is like shooting at a moving target. Also, there is no reason to assume that past betas will be similar to future betas.

Distinguishing Alpha and Beta

LO 32.3: Demonstrate knowledge of the concept of separating alpha and beta.

For example:

- **Describe the concept of separation of alpha and beta.**

It is important to identify how much of a strategy's return results from beta (i.e., risk) and how much results from alpha (i.e., active management). This is known as **distinguishing alpha and beta**. A manager who uses statistical techniques, quantitative tools, and benchmarking to discern whether high returns are the result of the superior performance of an active manager or a function of bearing high levels of systematic risk is attempting to distinguish alpha from beta.

A firm may attempt to independently manage alpha and beta. The firm may manage beta exposure while separately managing the portfolio's alpha. This is known as **separating alpha and beta**. Managers can use investment tools to pursue alpha while sustaining a target beta for the portfolio. Managers typically seek to limit beta while trying to optimize alpha. Derivatives are often used to minimize or eliminate undesired systematic risk.

For example, assume a manager's benchmark is the S&P 500. He would like to pursue opportunities that increase alpha, but the result is beta exposure that is different from the benchmark. He can use futures contracts to hedge all systematic risks other than exposure to the S&P 500 such that the portfolio's beta relative to the S&P 500 is 1.0. He does this while simultaneously pursuing an alpha optimizing strategy. In this way, he is independently managing, or separating, alpha from beta.

Portable Alpha

LO 32.4: Demonstrate knowledge of portable alpha.

For example:

- **Demonstrate how to transfer risk with appropriately-sized positions in derivatives.**
- **Apply the concept of notional value to determine futures positions designed to transfer risk.**
- **Discuss the application of portable alpha using futures contracts.**
- **Apply the concept of portable alpha to portfolio management.**
- **Discuss challenges with porting alpha.**

The concept of separating alpha and beta is closely related to portable alpha. **Portable alpha** involves exploiting opportunities to increase alpha while simultaneously managing beta exposure to a target level.

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Transferring Risk with Appropriately Sized Derivatives

It is possible to control beta while porting alpha with derivatives. For example, consider an active manager with the S&P 500 designated as the appropriate benchmark for the strategic allocation of the portfolio. She generates alpha by investing in small-cap stocks but is concerned that the systematic risk of small-cap stocks is different from the benchmark.

The goal of the active strategy is to generate alpha relative to a benchmark appropriate to the strategy. In this case, the Russell 2000 might be an appropriate benchmark for the alpha generating strategy. To align the systematic risk of the portfolio with the benchmark, she can take a short position in futures contracts on an index with characteristics similar to the small-cap securities (i.e., the Russell 2000). At the same time, she should take a long position in S&P 500 futures contracts to ensure that the portfolio has the desired exposure to the benchmark. She must determine the appropriately sized derivatives contracts to accomplish both goals.

The futures position needed to hedge is equal to the size of the position to be hedged times the beta of the position being hedge relative to the index. This is illustrated in the following equation:

$$\text{futures contract's notional value for hedging} = \text{value of the position to be hedged} \times \text{beta}$$

The number of contracts required to hedge is determined by dividing the futures contract's notional value for hedging, determined above, by the relevant index value multiplied by the index multiplier. The equation is:

$$\text{number of contracts} = \frac{\text{future contract notional value}}{\text{index value} \times \text{multiplier}}$$

Example: Hedging with futures contracts

For simplicity, assume the basis is zero and the index has a beta of 1.0. Shannon White, a manager with McCarthy Funds, manages a $5,000,000 portfolio with a beta of 1.3 relative to the index. The appropriate index for hedging has a value of 1,500 and a multiplier of 250. **Calculate** the notional value of the futures contracts and the number of contracts required to implement the hedge.

Answer:

The notional value of futures contracts required to hedge the position is:

$$\$5{,}000{,}000 \times 1.3 = \$6{,}500{,}000$$

The number of contracts required to hedge the position is:

$$\frac{\$6{,}500{,}000}{1{,}500 \times 250} = 17.333 \text{ contracts} \approx 17 \text{ contracts}$$

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Portable Alpha Applications

There are several ways to separate alpha from beta. Alternative methods used to offset small-cap or other risks and layer on the systematic risk of a benchmark include:

- Futures contracts.
- Swap contracts.
- Options.
- Long and short positions in indices using exchange-traded funds (ETFs) and cash products.

When using futures to offset small-cap risk and layer on the risk of the S&P 500, the process involves:

- Investing cash in the small-cap strategy to generate positive alpha.
- Taking a short position in a small-cap index (e.g., the Russell 2000) using futures contracts to offset small-cap risk.
- Taking a long position in the S&P 500 via S&P 500 futures contracts to layer on the risk exposure of large-cap stocks and bring systematic risk exposure in line with the benchmark (i.e., the S&P 500).

The return from the strategy should ideally equal the return on the benchmark plus the alpha generated from the small-cap strategy relative to the small-cap benchmark. **Tracking error** is likely to occur if the alpha generating strategy is not perfectly correlated with its benchmark (i.e., the Russell 2000 in this example). Tracking error increases the total risk of the portfolio beyond that of the S&P 500. However, it is expected to be idiosyncratic risk and could possibly be diversified away.

Alpha cannot be ported in all cases. For example, a manager who generates alpha by investing in private equity deals may not be able to offset the risk of the private equity sector because short-selling and derivative contacts are not readily available. Potential hedging instruments do not exist for all investment opportunities. Thus, hedging may be difficult or impossible in some cases.

Example: Calculating return of portable alpha strategy

Bob Higgins has a $100 million dollar portfolio. The portfolio benchmark is the S&P 500. The expected return on large-cap stocks is 10%. The risk-free rate is 0%. Higgins decides to invest 50% of the portfolio in the S&P 500 and the balance in a hedge fund with significant small-cap stock exposure. The alpha (i.e., return in excess of small-cap index return) generated by the hedge fund is 1.5%. The expected return on the small-cap index is 14%. The beta of the hedge fund relative to the small-cap index is 0.5 (the beta is relevant for determining the number of contracts required to hedge the small-cap risk, as discussed previously).

Higgins can use the concept of portable alpha by taking a long position in S&P 500 futures with the same exposure as the $50 million invested in the S&P 500. Higgins will sell futures on a small-cap index. This position will be the size of the small-cap exposure, adjusted for the beta. **Calculate** the expected total return of Higgins' strategy.

Answer:

The goal of Higgins is to have a total of $100 million invested with a risk level that matches the S&P 500 while earning risk-free alpha from the hedge fund.

As a result, he has a 50% ($50 million) long position in the S&P 500 and a 50% ($50 million) long position in the hedge fund with small-cap exposure.

In order to match the equivalent S&P 500 return on $100 million, he establishes a $50 million long futures position in the S&P 500.

Higgins still needs to determine the small-cap beta exposure and hedge it with a short futures position on a small-cap index.

S&P 500

Position size: $50 million long position + $50 million futures position = $100 million
Percentage return: 10% (given)
Monetary return: $100 million × 10% (given) = $10 million

Hedge Fund

Position size: $50 million
Percentage return: 14% × 0.5 + 1.5% = 8.5%
Monetary return: 8.5% × $50 million = $4.25 million

Short Small-Cap Futures

Position size: $50 million × 0.5 beta = $25 million
Percentage return: –14% (given)
Monetary return: $25 million × –14% = –$3.5 million

Total Return

Monetary return: $10 million + $4.25 million + –$3.5 million = $10.75 million
Percentage return: $10.75 million / $100 million = 10.75%

Another way to look at this example is that Higgins earns the 10% S&P 500 return on the entire $100 million plus the alpha on the $50 million invested in the hedge fund.

expected total return = 10% on $100 million + 1.5% alpha on $50 million

= ($10 million + 0.75 million) / $100 million = 10.75%

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Professor's Note: The idea here, as described previously, is to earn the alpha while hedging away the risk of the alpha generating strategy (i.e., the risk of the small-cap exposure). The net result is the systematic risk of the benchmark with the return of the benchmark plus the alpha generated by active management. Tracking error will cause the total risk of the portfolio to exceed that of a pure investment in the benchmark, the S&P 500 in this case, because the correlation between the small-cap index return and the hedge fund return is not perfect. If there is no hedging instrument available due to the nature of the strategy (e.g., private equity), the risk resulting from the alpha generating strategy will be borne by the investor.

Example: Calculating required futures contracts

Continuing the previous example, assume the value of S&P 500 is 1,800 and the multiplier is 500 times the index value. In addition, assume the small-cap index value is 1,000 and the multiplier is 250. **Calculate** the number of futures contracts needed to accomplish Higgins' strategy.

Answer:

In order to take on the risk of the large-cap stocks, the number of contracts is:

$$\frac{\$50 \text{ million}}{1{,}800 \times 500} = 55.55 \text{ contracts} \approx 56 \text{ contracts}$$

In order to offset the risk of the hedge fund strategy, the number of contracts Higgins must short is:

$$\frac{\$50 \text{ million} \times 0.5}{1{,}000 \times 250} = 100 \text{ contracts}$$

As the risk increases, so does the number of contracts required to hedge the risk. For example, if the beta had been 0.7 instead of 0.5, the number of contracts required to hedge the position would have been:

$$\frac{\$50 \text{ million} \times 0.7}{1{,}000 \times 250} = 140 \text{ contracts}$$

Professor's Note: You could be asked to express the alpha in basis points instead of percent. Thus, in the above example, the alpha is 75 basis points or 50% of the 150 basis point annual alpha derived from the strategy (remember: we only put one-half of the portfolio in the hedge fund strategy). Also, instead of the example relying on small-cap stocks to generate alpha, it could be tied to another country or another strategy. The process is the same; add on the risk of the benchmark so that the total portfolio has a long position in the benchmark via cash and long futures positions. Offset the risk of the alpha generating strategy by taking a short futures position in the appropriate index, whether it be small-cap stocks, the equity index of another country, et cetera. And remember that it is not always possible to offset the risk if there is not an appropriate hedging instrument. For example, there may not be a futures contract that has similar risk to a private equity strategy used to generate alpha.

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Portable Alpha Challenges

The previous examples rely on idealized conditions, such as a zero risk-free rate of interest, no transactions costs, and no dividends. These assumptions do not hold in the real world and therefore may reduce the effectiveness of portable alpha programs. We also assume that the estimation of alpha and beta are correct, which allows for the construction of an appropriate hedge.

Implementing a portable alpha program is complicated and requires the following:

- **Estimation of alpha.** If alpha is not stable through time, the strategy could port a negative alpha to a passive index, resulting in underperformance relative to the benchmark. There could be a substantial difference in performance on a risk-adjusted basis.
- **Estimation of beta.** If beta is incorrectly estimated or is changing through time (i.e., dynamic), the systematic risk of the strategy will be higher than expected.
- **Construction of an appropriate hedge.** The appropriate strategy should hedge the beta risk of the alpha-generating strategy and take on the beta risk of the benchmark.

One approach to avoid problems with estimation is to port the alpha of a portfolio of active managers rather than that of a single manager. Another approach to port alpha is to minimize the risk of the portfolio as a whole. In this approach, all risks (including risks of the hedging positon that cannot be hedged) are considered. As a result, this risk minimization approach typically uses lower position sizes for the hedge due to its higher measured risk.

Asset Allocation

LO 32.5: Demonstrate knowledge of asset allocation using the concepts of alpha and beta.

For example:
- **Describe the process of traditional asset allocation.**
- **Explain strategic and tactical asset allocation.**
- **Describe the new investment model.**
- **Discuss active risk and active returns for traditional investment products.**
- **Evaluate the proposition that alpha is a zero-sum game.**

Traditional Asset Allocation

The **traditional approach to portfolio allocation** involves:

- *Strategic asset allocation.* These are top-level, long-term target allocations for the portfolio. Strategic decisions are based on the risk/return preferences and constraints of the investor. If there is no active management, the strategic allocation decision is the only one that must be made.
- *Tactical asset allocation.* These are the decisions that active managers make to capitalize on opportunities identified in the market. Tactical asset allocation decisions alter the systematic risks of the portfolio in an effort to earn higher risk-adjusted returns. Some argue that the goal is to earn alpha by timing beta exposures in the market.
- *Selecting managers and/or securities with superior risk-adjusted returns.* For managers of traditional asset portfolios, this means choosing the best securities. For alternative asset managers, this often means choosing the best fund managers.

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The problem with the traditional approach is that it provides little flexibility with respect to asset allocations and benchmarks. Alpha opportunities are not central to the approach and thus managers often find themselves seeking alpha in highly efficient markets, such as bond and stock markets, rather than in alternative asset classes.

For example, a pension fund that has a strategic allocation restricted to stocks and bonds will be forced to increase the risk of the portfolio by decreasing the fixed income allocation and increasing the equity allocation if directors believe this will increase return. In other words, the portfolio does not have opportunities to seek alpha and thus must increase beta to increase returns. However, this is risky since a higher beta may mean even poorer returns in market downturns.

New Investment Model

The **new investment model** is more flexible than the traditional model. In the new model, alpha is sought independent of beta. Managers are afforded the opportunity to seek alpha, even if it means investing outside the benchmark. Alternative asset classes are often included in this more flexible approach. Risk budgeting is necessary and the manager is seeking opportunities that provide the greatest alpha per unit of nonsystematic or idiosyncratic risk. Systematic risks can be hedged, as described earlier. Portable alpha, or separating alpha from beta, is central to this approach.

Active Risks and Returns for Traditional Investments

Passively managed portfolios focus on buying and holding a mix of securities to meet risk and return objectives, which may be expressed as a benchmark.

Actively managed portfolios attempt to create better risk and return combinations by actively buying and selling securities. **Active risks** are the risks that arise when a manager makes investment decisions designed to beat the returns of a specified benchmark. Risks are both systematic and idiosyncratic. **Active return** is the return that results when a manager makes investment decisions designed to earn returns in excess of a passively managed benchmark. Traditional approaches vary in the degree to which portfolios are actively managed.

Traditional asset allocation approaches include using:

- **Passive management products.** Here, **index products** are used to earn the benchmark return. The approach is not designed to generate active returns or assume active risks. ETFs and other replication products are used to cost-effectively attain systematic risk premiums.
- **Enhanced index products.** Small, consistent alpha is the objective of these products. Slightly more risk is taken within tightly controlled parameters.
- **Long-only active products.** Managers of these investments claim to be earning alpha, but may instead be earning pure beta.

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Alpha as a Zero-Sum Game

In a **zero-sum game**, the gain to one participant is exactly offset by a loss to another participant. Alpha is a zero-sum game if the following assumptions hold:

- All investors have identical investment horizons.
- All investors have identical risk tolerance.
- Markets are not segmented (i.e., all investors can invest in all assets).
- Investors have homogeneous expectations about risk and return.
- Zero or equal taxes for all investors.
- Zero transactions costs.

These assumptions do not hold in the real world; therefore, alpha may not be a zero-sum game. Consider a bank that would like to lower its exposure to mortgages and an endowment that would like to increase its exposure to mortgages. The bank can sell its mortgages, which can be bundled into a mortgage-backed security (MBS) and resold. The endowment can then purchase a portion of the collateralized mortgage obligation (CMO). Due to differing levels of risk aversion, both the bank and the endowment can realize alpha from these decisions.

Futures markets provide another example that alpha is not a zero-sum game. Some participants use futures markets to protect future income and costs. These participants are willing to pay a premium to investors willing to assume these risks (e.g., managed futures investors). Thus, managed futures investors are able to earn an alpha by providing a service to those investors willing to pay a premium.

Wrap-Up

Investment managers may be able to optimize alpha and beta by managing them independently. Portable alpha allows the manager to pursue alpha while managing beta to a target level. The new investment model relies on portable alpha and the separation of alpha and beta. It provides managers with the flexibility to step outside traditional asset classes and look for opportunities in alternative asset classes.

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Key Concepts

LO 32.1

Smart beta strategies use rules-based portfolio weights that differ from market capitalization weights in an attempt to deliver improved risk and returns. Characteristics of smart beta strategies include:

- Attempt to capture a systemic risk premium.
- Utilize rules that rely on security characteristics.
- Have portfolio weights that differ from market capitalization weights.
- Maintain broad portfolios.

LO 32.2.

Alpha is the return in excess of the compensation for risk. Beta is a measure of the systematic risk of the security or portfolio relative to the market as a whole. Both alpha and beta are unobservable and must be estimated using historical data. This gives rise to potential errors in estimation.

LO 32.3

Firms may independently manage alpha and beta. This is known as separating alpha and beta. Managers can use investment tools to pursue alpha while sustaining a target beta for the portfolio.

LO 32.4

Portable alpha involves exploiting opportunities to increase alpha while simultaneously managing beta exposure to a target level. This may be done with derivatives contracts such as futures, options, or swaps.

The futures position needed to hedge is equal to the size of the position to be hedged times the beta of the position being hedged relative to the index, which is:

$$\text{futures contract's notional value for hedging} = \text{value of the position to be hedged} \times \text{beta}$$

The number of contracts required to hedge is determined by dividing the futures contract's notional value for hedging, determined above, by the relevant index value multiplied by the contract's multiplier which is:

$$\text{number of contracts} = \frac{\text{future contract notional value}}{\text{index value} \times \text{multiplier}}$$

Implementing a portable alpha program is complicated because it requires:

- Estimation of alpha.
- Estimation of beta.
- Construction of an appropriate hedge.

If alpha and beta are estimated incorrectly or are unstable across time, the actual results of a portable alpha strategy may be quite different from the expected outcome.

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LO 32.5

The traditional approach to asset allocation involves:

- Strategic asset allocation decisions. These are top-level, long-term target allocations for the portfolio and are based on the risk/return preferences and constraints of the investor.
- Tactical asset allocation decisions. These are the decisions that active managers make to capitalize on opportunities identified in the market.
- Selecting managers and/or securities with superior risk-adjusted returns.

The new investment model is more flexible than the traditional model; alpha is sought independent of beta. Alternative asset classes may be used in the new model.

Actively managed portfolios contain active risks and active returns. Active risks are the risks that arise when a manager makes investment decisions designed to beat the returns of a specified benchmark. Active return is the return that results when a manager makes investment decisions designed to earn returns in excess of a passively managed benchmark.

Traditional asset allocation approaches include using:

- Passive management products.
- Enhanced index products.
- Long-only active products.

Alpha is a zero-sum game if the following assumptions hold:

- Identical investment horizons.
- Identical risk tolerances.
- No market segmentation.
- Homogeneous expectations about risk and return.
- Zero taxes or equal taxes for all.
- Zero transactions costs.

These assumptions do not hold in the real world; therefore, alpha may not be a zero-sum game.

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Concept Checkers

1. Which of the followings measures should be used to assess the risk-adjusted return of an active portfolio manager?
   A. Alpha.
   B. Beta.
   C. Gamma.
   D. Theta.

2. Grayson Baldwin would like to pursue alpha in small cap stocks, despite the fact that the performance benchmark he utilizes is the S&P 500. He would like to offset the beta risk of the small cap investments in order to maintain a target beta for the portfolio. This concept is called:
   A. distinguishing between alpha and beta.
   B. separating alpha and beta.
   C. distinguishing between strategic and tactical asset allocation.
   D. portable beta.

3. Greg Cowgill manages a $10 million portfolio with a beta of 1.1 relative to the index. If the appropriate index for hedging has a value of 2,200 and a multiplier of 500, how many contracts are required to hedge?
   A. 63 contracts.
   B. 100 contracts.
   C. 12 contracts.
   D. 10 contracts.

4. A key difference between the new investment model and traditional asset allocation is:
   A. the ability to use futures contracts in the new investment model.
   B. the requirement that managers not deviate from the strategic allocation in the new investment model.
   C. more flexibility to seek alpha in the new investment model.
   D. the requirement that all alpha seeking opportunities be offset by increases in beta risk in the new investment model.

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Concept Checker Answers

1. **A** Alpha is a measure of risk-adjusted return. It is the return in excess of the compensation for risk. It is often used to assess the performance of active managers. (LO 32.2)

2. **B** Baldwin is attempting to independently manage alpha and beta. He is managing beta exposure while separately managing the portfolio's alpha. This is known as separating alpha and beta. (LO 32.3)

3. **D** The notional value of futures contracts required to hedge the position is:

   $10 million × 1.1 = $11 million

   The number of contracts required to hedge the position is:

   $$\frac{\$11 \text{ million}}{2{,}200 \times 500} = 10 \text{ contracts}$$

   (LO 32.4)

4. **C** The new model provides managers with more flexibility to seek alpha opportunities. Portable alpha is a key component to the new investment model. (LO 32.5)

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Formulas

annual fee = mgt fee%(NAV_{beg}) + {max[0,(incentive fee %) × (GR – mgt fee – hurdle)]}

incentive fee payout = max[i(NAV_{end} – NAV_{beg}),0]

incentive fee call option value = i × 40% × NAV × σ_1

simple moving average: $SMA_t = \frac{\sum_{t=1}^{n} P_{t-1}}{n}$

weighted moving average: $WMA_t(n) = \frac{n}{N}P_{t-1} + \frac{n-1}{N}P_{t-2} + \ldots + \frac{1}{N}P_{t-n}$

exponential moving average:

$$EMA_t(\lambda) = \lambda P_{t-1} + \lambda(1-\lambda)P_{t-2} + \lambda(1-\lambda)^2 P_{t-3} + \lambda(1-\lambda)^3 P_{t-4} + \ldots$$

relative strength index: $RSI = 100 - \frac{100}{1 + \frac{U}{D}}$

convertible bond value = straight bond value + call option value

option strike price = $\frac{\text{convertible bond face value}}{\text{conversion ratio}}$

conversion value = conversion ratio × stock price

conversion premium = $\frac{\text{convertible bond price} - \text{conversion value}}{\text{conversion value}}$

variance notional value = $\frac{\text{vega notional value}}{2 \times \sqrt{\text{strike variance}}}$

variance swap payoff = $\frac{\text{vega notional value} \times (\text{realized variance} - \text{strike variance})}{2 \times \sqrt{\text{strike variance}}}$ Provided on Exam

variance swap payoff (variance given):

$$\text{variance swap payoff} = \text{variance notional value} \times (\text{realized variance} - \text{strike variance})$$

total accruals = ΔCA – ΔCL – ΔCASH + ΔSTDEBT – D&A Provided on Exam

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standardized unexpected earnings: $SUE = \frac{EPS - ACEPS}{SDEM}$

information ratio: $IR = IC \times \sqrt{Breadth}$

LBO return = $\left(\frac{\text{firm value at the end of debt paydown period}}{\text{equity portion of LBO transaction}}\right)^{\left(\frac{1}{\text{debt paydown period}}\right)} - 1$

expected credit loss = PD × EAD × LGD

or equivalently:

expected credit loss = PD × EAD × (1 – RR)

risk-neutral approach to bond pricing:

$$B(0,1) = \lambda \times \frac{K \times RR}{(1+r)} + (1-\lambda) \times \frac{K}{(1+r)} = \frac{K}{(1+r)}(\lambda \times RR + (1-\lambda))$$

Provided on Exam

bond price: $B(0,1) = \frac{K}{1+r+s}$

theoretical standard deviation of a portfolio: $\sigma_p = \frac{\sigma_f}{\sqrt{n}}$

premium/discount of closed-end fund:

premium (discount) as a percentage of NAV = (market price / NAV) – 1

credit put option payout: payout = Max[0, X – B(t)] if in default, and 0 otherwise

after-tax return on investment: r* = r (1 – T)

after-tax rate on a tax-deferred investment: $r^* = \left\{1 + \left[(1+r)^N - 1\right](1-T)\right\}^{\frac{1}{N}} - 1$

after-tax return on a tax-deferred, tax-deductible investment: $r^* = \left[(1+r)^N \times \left(\frac{1-T_N}{1-T_0}\right)\right]^{\frac{1}{N}} - 1$

U.S.-based structured product:

product = underlying asset + bear put spread – out-of-the-money call

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French-based structured product:

product = underlying portfolio + portfolio of bear spreads + portfolio of short binary puts

German-based structured product: product = underlying asset + bull spread

U.K.-based structured product:

product = at-the-money up-and-out call + at-the-money down-and-out put

Swiss-based structured product:

product = + at-the-money call + 2 at-the-money down-and-out puts – at-the-money put

return on equity: ROE = (ROA × L) – [r × (L – 1)]

put-call parity: put – call + stock = riskless bond

leverage ratio: L = A/E

probability of bond default: $\lambda = \frac{1}{1-RR}\left(\frac{s}{1+r+s}\right)$

approximate probability of bond default: $\lambda \approx \frac{s}{1-RR}$

notional futures contract value for hedging = value of the position to be hedged × beta

number of futures contracts needed to hedge = $\frac{\text{future contract notional value}}{\text{index value} \times \text{multiplier}}$

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