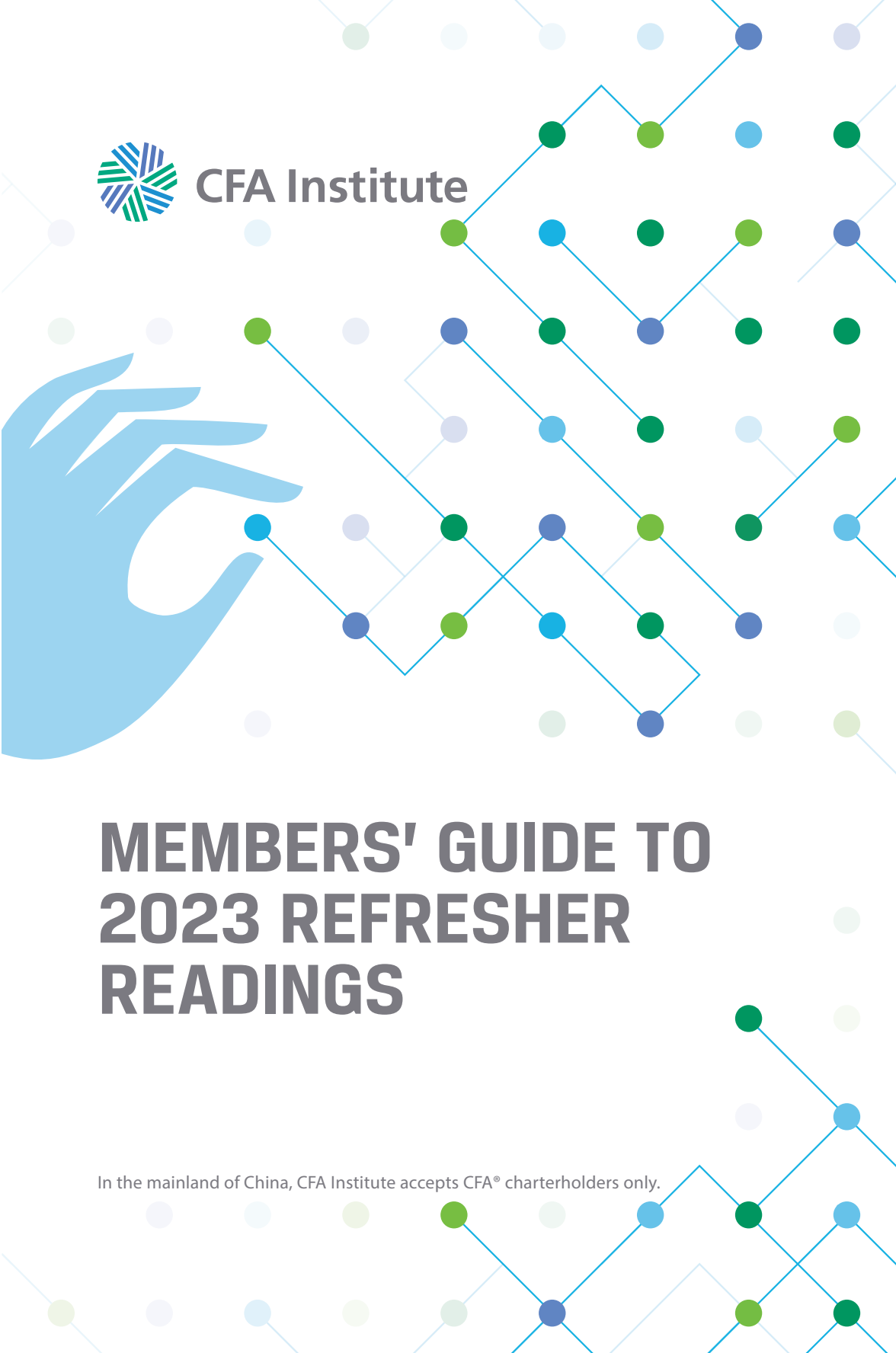

CFA Institute

MEMBERS' GUIDE TO 2023 REFRESHER READINGS

In the mainland of China, CFA Institute accepts CFA® charterholders only.

Contents

Foreword

As the investment industry continues to evolve, our Professional Learning team remains committed to delivering flexible learning opportunities in formats that fit our member's needs across a wide variety of topic areas to help you upskill and reskill throughout your career. We encourage you to take advantage of these opportunities—ranging from online self-paced courses and live instructor-led trainings, to the latest research and industry insights and more—and to access high-quality, practitioner-relevant content that will help you reach your personal and professional goals.

Year after year, our Refresher Readings have proven to be one of our most popular Professional Learning products. This popularity shows our members' commitment to keeping their skills and knowledge current. We are excited to share the latest developments in the CFA® Program curriculum—the source of the Refresher Readings you can access as an exclusive member benefit.

Last year, we made comprehensive changes to the CFA Program curriculum. The 2023 readings build on those improvements by evolving the structure of the curriculum, improving key topic areas, and reflecting the extensive work coming out of Practice Analysis and curriculum development.

A significant change in the curriculum in recent years comes at Level I. By revising the material to a learning module structure, we have aligned the content with best practice to meet adult learners' needs. Each module is designed to be completed in one sitting, and practice questions are included throughout. The modules incorporate more visuals and realistic content, plus expert demonstrations followed by opportunities for CFA charterholders and CFA Institute members to practice the skills.

In addition to modernizing the format and presentation, key changes from the 2023 curriculum appear in the following categories:

- An updated and expanded analysis explains the use of **derivatives** in the investment industry and how investment professionals navigate derivative markets.
- A new "Introduction to Geopolitics" reading at Level I in the **economics** topic area provides a structure for thinking about a wide range of geopolitical issues and assessing their risks.
- New and updated readings in the **corporate issuers** (formerly corporate finance) topic area include refreshed environmental, social, and governance (ESG) content, general partner and limited partner structures, and more. In particular, the "Corporate Restructuring" reading at Level II covers all types of corporate restructurings and explains how to model them using spreadsheet modeling.
- **Alternative investments** readings have been modularized and now reflect greater depth and detail. For Level II, three integrated modules cover various topics in real estate, including investments through private vehicles and publicly traded securities.
- New content highlights decentralized finance and blockchain in the **portfolio management** topic area.
- Multiple regression content has been updated with investment-focused datasets in the **quantitative methods** topic area. At Level II, the material now includes information on evaluating outliers and influential observations as well as expanded content on logistic regression, an important foundation for neural network estimation.

- A new vignette in the "Application of the Code and Standards" reading at Level II helps members refine their **ethics** expertise.

I hope you find these Refresher Readings applicable to your day-to-day work. We welcome your feedback on our Professional Learning program and resources. Please contact us at professionallearning@cfainstitute.org.

Barbara Petitt, PhD, CFA
Managing Director, Professional Learning

Derivatives

Readings

Reading	Level	PL Credits	Link
Derivative Instrument and Derivative Market Features	I	0.75	cfainst.is/derivatives
Forward Commitment and Contingent Claim Features and Instruments	I	1	cfainst.is/forward-commitment
Derivative Benefits, Risks, and Issuer and Investor Uses	I	0.75	cfainst.is/derivativebenefitsrisks
Arbitrage, Replication, and the Cost of Carry in Pricing Derivatives	I	0.75	cfainst.is/arbitrage
Pricing and Valuation of Forward Contracts and for an Underlying with Varying Maturities	I	1	cfainst.is/forwardcontracts
Pricing and Valuation of Futures Contracts	I	0.75	cfainst.is/futures
Pricing and Valuation of Interest Rates and Other Swaps	I	0.75	cfainst.is/swaps
Pricing and Valuation of Options	I	0.75	cfainst.is/options
Option Replication Using Put–Call Parity	I	0.5	cfainst.is/putcall
Valuing a Derivative Using a One-Period Binomial Model	I	0.75	cfainst.is/binomial

What Is Changing in the 2023 Curriculum, and Why Does It Matter?

The biggest change to the curriculum for 2023 is an updated and expanded analysis of the use of derivatives in the investment industry and explanation of how investment managers navigate derivative markets. This new content is designed around learning modules that can be mastered in an evening of study. The expanded derivatives content incorporates a wealth of visuals and realistic content, plus expert demonstrations and opportunities for learners to practice their skills.

The new "**Derivative Instrument and Derivative Market Features"** learning module defines derivatives and describes their basic features. It presents an overview of derivative markets and compares over-the-counter and exchange-traded markets.

This reading shows how derivatives expand the set of investment opportunities beyond the cash market to create or modify exposure to an underlying security. Given that derivatives are increasingly centrally cleared today, the discussion of how central counterparties (CCPs) assume the counterparty credit risk and provide clearing and settlement services is an important new addition for readers to understand.

The "**Forward Commitment and Contingent Claim Features and Instruments**" reading defines forward contracts, futures contracts, swaps, options (calls and puts), and credit derivatives; compares their characteristics; and shows how to determine their value at

expiration. This reading also sets out how investors can profit from a long or a short position in a call or put option.

Users of forward commitments should be able to calculate their values at maturity and this reading demonstrates how to do this. It highlights how credit default swap (CDS) contracts allow an investor to manage the risk of loss from issuer default separately from a cash bond. The reading focuses on how market participants can create similar exposures to an underlying asset using firm commitments and contingent claims.

The new "**Derivative Benefits, Risks, and Issuer and Investor Uses**" reading describes the benefits and risks of using derivatives and compares their use among issuers and investors.

Derivatives can offer greater operational and market efficiency than cash markets and allow investors to create exposures unavailable in cash markets. It is important, however, to understand the risk these derivative positions can entail. Excessive risk taking by market participants has contributed to market destabilization and systemic risk in the past. As the reading makes clear, users of derivative instruments must be able to manage risks, including a high degree of implicit leverage and less transparency, along with basis, liquidity, and counterparty credit risks.

How the price of a forward commitment is related to the spot price of an underlying asset is explored in the "**Arbitrage, Replication, and the Cost of Carry in Pricing Derivatives**" reading. This reading also demonstrates how costs or benefits associated with owning an underlying asset affect the forward price.

Knowing the key features of derivatives is necessary, but not sufficient, to use them successfully. This reading explains the pricing and valuation of forward commitments on a mark-to-market basis from inception through maturity. This analysis is essential for issuers, investors, and financial intermediaries to assess the value of any

asset or liability portfolio that includes these instruments. It also addresses forward pricing for the special case of underlying assets with different maturities, such as interest rates, credit spreads, and volatility. The prices of these forward commitments across the term structure are an important building block for pricing swaps and related instruments.

How the value and price of a forward contract are determined at initiation, during the life of the contract, and at expiration are all detailed in "**Pricing and Valuation of Forward Contracts and for an Underlying with Varying Maturities**." This reading sets out how forward rates are determined for an underlying asset with a term structure and describes the uses of forwards. Furthermore, the reading explains what distinguishes futures from other forward commitments and how they are used by issuers and investors.

The "**Pricing and Valuation of Futures Contracts**" reading places a particular focus on the interest rate futures market and its role in interest rate derivative contracts. Analysts need to understand how daily settlement and margin requirements give rise to different cash flow patterns between futures and forwards, resulting in a pricing difference between the two contract types. In addition, the emergence of derivatives central clearing has introduced futures-like margining requirements for over-the-counter (OTC) derivatives, such as forwards.

While financial intermediaries often use forward rate agreements or short-term interest rate futures contracts to manage interest rate exposure, issuers and investors usually prefer swap contracts because they better match rate-sensitive assets and liabilities. The "**Pricing and Valuation of Interest Rate and Other Swaps**" reading explores how swaps are related to other forward commitment types.

It is important for market participants not only to be able to match expected future cash flows using swaps but also to ensure that

their change in value is consistent with existing or desired underlying exposures. This reading compares swap contracts with forward contracts and contrasts the value and price of swaps.

"**Pricing and Valuation of Options**" outlines three features unique to contingent claims related to an option's value versus the spot price of the underlying asset. This reading then turns to how arbitrage and replication concepts can be applied to contingent claims with an asymmetric payoff profile. It also identifies the key factors determining the value of an option.

The nonlinear or asymmetric payoff profile of an option, a contingent claim, means analysts must approach these derivative instruments different from a forward, firm commitment. This reading explains how to determine the value of an option from the value of the underlying, the exercise price, the time to maturity, the risk-free rate, the volatility of the underlying price, and any income or cost associated with owning the underlying asset.

The new "**Option Replication Using Put–Call Parity**" reading shows how the value of a European call may be used to derive the value of a European put option with the same underlying details, and vice versa, under a no-arbitrage condition referred to as put–call parity. It then demonstrates how this value can be extended to forward commitments.

This reading shows how to combine options to have an equivalent payoff to that of the underlying and a risk-free asset as well as a forward commitment. As the reading explains, the insights established by the put–call parity relationship go well beyond option trading strategies, extending to modeling the value of a firm to describe the interests and financial claims of a firm's equity and debt owners.

Forward commitments can be priced without making assumptions about the underlying asset's price in the future. The pricing of options and other contingent claims requires a model for the

evolution of the underlying asset's future price. The "**Valuing a Derivative Using a One-Period Binomial Model**" reading presents just such a model. The one-period binomial model can be extended to multiple periods as well to value more complex contingent claims.

Derivative Instrument and Derivative Market Features

- Level I
- 0.75 PL Credits
- Access the full reading: cfainst.is/derivatives

Learning Outcomes

The member should be able to:

- define a derivative and describe basic features of a derivative instrument;
- describe the basic features of derivative markets; and
- contrast over-the-counter (OTC) and exchange-traded derivative (ETD) markets.

Introduction

Earlier lessons described markets for financial assets related to equities, fixed income, currencies, and commodities. These markets are known as cash markets or spot markets in which specific assets are exchanged at current prices referred to as cash prices or spot prices.

Derivatives involve the future exchange of cash flows whose value is derived from or based on an underlying value. The following lessons define and describe features of derivative instruments and derivative markets.

Summary

- A derivative is a financial contract that derives its value from the performance of an underlying asset, which may represent a firm commitment or a contingent claim.
- Derivative markets expand the set of opportunities available to market participants beyond the cash market to create or modify exposure to an underlying.
- The most common derivative underlying assets include equities, fixed income and interest rates, currencies, commodities, and credit.
- OTC derivative markets involve the initiation of customized, flexible contracts between derivatives end users and financial intermediaries.
- ETDs are standardized contracts traded on an organized exchange, which requires collateral on deposit to protect against counterparty default.
- For derivatives that are centrally cleared, a central counterparty (CCP) assumes the counterparty credit risk of the derivative counterparties and provides clearing and settlement services.

Forward Commitment and Contingent Claim Features and Instruments

- Level I
- 1 PL Credit
- Access the full reading: cfainst.is/forwardcommitment

Learning Outcomes

The member should be able to:

- define forward contracts, futures contracts, swaps, options (calls and puts), and credit derivatives and compare their basic characteristics;
- determine the value at expiration and profit from a long or a short position in a call or put option; and
- contrast forward commitments with contingent claims.

Introduction

An earlier lesson established a derivative as a financial instrument that derives its performance from an underlying asset, index, or other financial variable, such as equity price volatility. Primary derivative types include a firm commitment in which a predetermined amount is agreed to be exchanged between counterparties at settlement and a contingent claim in which one of the counterparties determines whether and when the trade will settle. The following lessons define and compare the basic features of forward commitments and contingent claims and explain how to calculate their values at maturity.

Summary

- Forwards, futures, and swaps represent firm commitments, or derivative contracts that require counterparties to exchange an underlying in the future based on an agreed-on price.
- Forwards are a flexible over-the-counter (OTC) derivative instrument, whereas futures are standardized and traded on an exchange with a daily settlement of contract gains and losses.
- Swap contracts are a firm commitment to exchange a series of cash flows in the future. Interest rate swaps are the most common type and involve the exchange of fixed interest payments for floating interest payments.
- Option contracts are contingent claims in which one of the counterparties determines whether and when a trade will settle. The option buyer pays a premium to the seller for the right to transact the underlying in the future at an agreed-upon exercise price.

- Credit default swap (CDS) contracts allow an investor to manage the risk of loss from issuer default separately from a cash bond.
- Market participants often create similar exposures to an underlying using firm commitments and contingent claims, although these derivative instrument types involve different payoff and profit profiles.

Derivative Benefits, Risks, and Issuer and Investor Uses

- Level I
- 0.75 PL Credits
- Access the full reading: cfainst.is/derivativebenefitsrisks

Learning Outcomes

The member should be able to:

- describe benefits and risks of derivative instruments, and
- compare the use of derivatives among issuers and investors.

Introduction

Earlier lessons described how derivatives expand the set of opportunities available to market participants to create or modify exposure or to hedge the price of an underlying. This learning module describes the benefits and risks of using derivatives and compares their use among issuers and investors.

Summary

- Derivatives allow market participants to allocate, manage, or trade exposure without exchanging an underlying in the cash market.
- Derivatives also offer greater operational and market efficiency than cash markets and allow users to create exposures unavailable in cash markets.
- Derivative instruments can involve risks, such as a high degree of implicit leverage and less transparency in some cases than cash instruments, as well as basis, liquidity, and counterparty credit risks. Excessive risk taking in the past by market participants through the use of derivatives has contributed to market destabilization and systemic risk.
- Issuers typically use derivative instruments to offset or hedge market-based underlying exposures that affect their assets, liabilities, and earnings.
- Issuers usually seek hedge accounting treatment for derivatives to minimize income statement and cash flow volatility.
- Investors use derivatives to modify investment portfolio cash flows, replicate investment strategy returns in cash markets, and create exposures unavailable to cash market participants.

Arbitrage, Replication, and the Cost of Carry in Pricing Derivatives

- Level I
- 0.75 PL Credits
- Access the full reading: cfainst.is/arbitrage

Learning Outcomes

The member should be able to:

- explain how the concepts of arbitrage and replication are used in pricing derivatives, and
- explain the difference between the spot and expected future price of an underlying and the cost of carry associated with holding the underlying asset.

Introduction

Earlier derivative lessons established the features of derivative instruments and markets and addressed both the benefits and risks

associated with their use. Forward commitments and contingent claims were distinguished by their different payoff profiles and other characteristics. We now turn our attention to the pricing and valuation of these instruments. As a first step, we explore how the price of a forward commitment is related to the spot price of an underlying asset in a way that does not allow for arbitrage opportunities. Specifically, the strategy of replication shows that identical payoffs to a forward commitment can be achieved from spot market transactions combined with borrowing or lending at the risk-free rate. Finally, the second lesson demonstrates how costs or benefits associated with owning an underlying asset affect the forward commitment price.

Summary

- Forward commitments are an alternative means of taking a long or short position in an underlying asset. A link between forward prices and spot prices exists to prevent investors from taking advantage of arbitrage opportunities across cash and derivative instruments.
- A forward commitment may be replicated with a long or short spot position in the underlying asset and borrowing or lending at a risk-free rate. Investors can recreate a variety of positions by using appropriate combinations of spot, forward, and risk-free positions.
- The risk-free rate provides a fundamental link between spot and forward prices for underlying assets with no additional costs or benefits of ownership.

- The cost of carry is the net of the costs and benefits related to owning an underlying asset for a specific period and must be factored into the difference between the spot price and a forward price of a specific underlying asset.
- The cost of carry may include costs, such as storage and insurance for physical commodities, or benefits of ownership, such as dividends for stocks and interest for bonds. Foreign exchange represents a special case in which the cost of carry is the interest rate differential between two currencies.
- Forward prices may be greater than or less than the underlying spot price, depending on the specific cost of carry associated with owning the underlying asset.

Pricing and Valuation of Forward Contracts and for an Underlying with Varying Maturities

- Level I
- 1 PL Credit
- Access the full reading: cfainst.is/forwardcontracts

Learning Outcomes

The member should be able to:

- explain how the value and price of a forward contract are determined at initiation, during the life of the contract, and at expiration; and
- explain how forward rates are determined for an underlying with a term structure and describe their uses.

Introduction

Earlier lessons introduced forward commitment features, payoff profiles, and concepts used in pricing these derivative instruments. In particular, the relationship between spot and forward commitment prices was established as the opportunity cost of owning the underlying asset (represented by the risk-free rate) as well as any additional cost or benefit associated with holding the underlying asset. This price relationship both prevents arbitrage and allows a forward commitment to be replicated using spot market transactions and risk-free borrowing or lending.

In the first lesson, we explore the pricing and valuation of forward commitments on a mark-to-market (MTM) basis from inception through maturity. This analysis is essential for issuers, investors, and financial intermediaries to assess the value of any asset or liability portfolio that includes these instruments. The second lesson addresses forward pricing for the special case of underlying assets with different maturities, such as interest rates, credit spreads, and volatility. The prices of these forward commitments across the so-called term structure are important building blocks for pricing swaps and related instruments in later lessons.

Summary

- A forward commitment price agreed upon at contract inception remains fixed and establishes the basis on which the underlying asset (or cash) will be exchanged in the future versus the spot price at maturity.

- For an underlying asset that does not generate cash flows, the value of a long forward commitment before expiration is equal to the current spot price of the underlying asset minus the present value of the forward price discounted at the risk-free rate. The reverse is true for a short forward commitment. Foreign exchange represents a special case in which the spot versus forward price is a function of the difference between risk-free rates across currencies.
- For an underlying asset with additional costs and benefits, the forward contract MTM value is adjusted by the sum of the present values of all additional cash flows through maturity.
- Underlying assets with a term structure, such as interest rates, have different rates or prices for different times-to-maturity. These zero or spot and forward rates are derived from coupon bonds and market reference rates and establish the building blocks of interest rate derivatives pricing.
- Implied forward rates represent a breakeven reinvestment rate linking short-dated and long-dated zero-coupon bonds over a specific period.
- A forward rate agreement (FRA) is a contract in which counterparties agree to apply a specific interest rate to a future period.

Pricing and Valuation of Futures Contracts

- Level I
- 0.75 PL Credits
- Access the full reading: cfainst.is/futures

Learning Outcomes

The member should be able to:

- compare the value and price of forward and futures contracts, and
- explain why forward and futures prices differ.

Introduction

Many of the pricing and valuation principles associated with forward commitments are common to both forward and futures contracts. For example, previous lessons demonstrated that forward commitments have a price that prevents market participants from earning riskless profit through arbitrage. It was shown that long and short forward commitments may be replicated using a combination of long

or short cash positions and borrowing or lending at the risk-free rate. Finally, both forward and futures pricing and valuation incorporate the cost of carry, or the benefits and costs of owning an underlying asset over the life of a derivative contract.

We now turn our attention to futures contracts. We discuss what distinguishes these contracts from other forward commitments and how they are used by issuers and investors. We expand on the daily settlement of futures contracts' gains and losses introduced earlier and explain the differences between forwards and futures. We also address and distinguish the interest rate futures market and its role in interest rate derivative contracts.

Summary

- Futures are standardized, exchange-traded derivatives (ETDs) with zero initial value and a futures price $f_0(T)$ established at inception. The futures price, $f_0(T)$, is equal to the spot price compounded at the risk-free rate as in the case of a forward contract.
- The primary difference between forward and futures valuation is the daily settlement of futures gains and losses through a margin account. The daily settlement resets the futures contract value to zero at the current futures price $f_t(T)$. This process continues until contract maturity and the futures price converges to the spot price, S_T.
- The cumulative realized mark-to-market (MTM) gain or loss on a futures contract is approximately the same as that for a comparable forward contract.

- Daily settlement and margin requirements give rise to different cash flow patterns between futures and forwards, resulting in a pricing difference between the two contract types. The difference depends on both interest rate volatility and the correlation between interest rates and futures prices.
- The futures price for short-term interest rate futures is given by (100 – yield), where yield is expressed in percentage terms. There is a price difference between interest rate futures and forward rate agreements (FRAs) because of a convexity bias.
- The emergence of derivatives central clearing has introduced futures-like margining requirements for over-the-counter (OTC) derivatives, such as forwards. This arrangement has reduced the difference in the cash flow impact of ETDs and OTC derivatives and the price difference in futures versus forwards.

Pricing and Valuation of Interest Rates and Other Swaps

- Level I
- 0.75 PL Credits
- Access the full reading: cfainst.is/swaps

Learning Outcomes

The member should be able to:

- describe how swap contracts are similar to but different from a series of forward contracts, and
- contrast the value and price of swaps.

Introduction

Swap contracts were introduced earlier as a firm commitment to exchange a series of cash flows in the future. Interest rate swaps in which fixed cash flows are exchanged for floating payments are the most common type. Subsequent lessons addressed the pricing and

valuation of forward and futures contracts across the term structure, which form the building blocks for swap contracts.

In this lesson, we will explore how swap contracts are related to these other forward commitment types. Although financial intermediaries often use forward rate agreements or short-term interest rate futures contracts to manage interest rate exposure, issuers and investors usually prefer swap contracts, because they better match rate-sensitive assets and liabilities with periodic cash flows, such as fixed-coupon bonds, variable-rate loans, or known future commitments. It is important for these market participants not only to be able to match expected future cash flows using swaps but also to ensure that their change in value is consistent with existing or desired underlying exposures. The following lessons compare swap contracts with forward contracts and contrast the value and price of swaps.

Summary

- A swap contract is an agreement between two counterparties to exchange a *series* of future cash flows, whereas a forward contract is a *single* exchange of value at a later date.
- Interest rate swaps are similar to forwards in that both contracts are firm commitments with symmetric payoff profiles and no cash is exchanged at inception, but they differ in that the fixed swap rate is constant, whereas a series of forward contracts has different forward rates at each maturity.
- A swap is priced by solving for the par swap rate, a fixed rate that sets the present value of all future expected floating cash flows equal to the present value of all future fixed cash flows.

- The value of a swap at inception is zero (ignoring transaction and counterparty credit costs). On any settlement date, the value of a swap equals the current settlement value plus the present value of all remaining future swap settlements.
- A swap contract's value changes as time passes and interest rates change. For example, a rise in expected forward rates increases the present value of floating payments, causing a mark-to-market (MTM) gain for the fixed-rate payer (floating-rate receiver) and an MTM loss for the fixed-rate receiver (floating-rate payer).

Pricing and Valuation of Options

- Level I
- 0.75 PL Credits
- Access the full reading: cfainst.is/options

Learning Outcomes

The member should be able to:

- explain the exercise value, moneyness, and time value of an option;
- contrast the use of arbitrage and replication concepts in pricing forward commitments and contingent claims; and
- identify the factors that determine the value of an option and describe how each factor affects the value of an option.

Introduction

Option contracts are contingent claims in which one of the counterparties determines whether and when a trade will settle. Unlike a forward commitment with a value of zero to both counterparties at

inception, an option buyer pays a premium to the seller for the right to transact the underlying in the future at an agreed-upon price. The contingent nature of options affects their price as well as their value over time.

In the first lesson, we explore three features distinct to contingent claims related to an option's value versus the spot price of the underlying: (1) the exercise, or intrinsic, value; (2) the relationship between an option's spot price and its exercise price, referred to as "moneyness"; and (3) the time value. We then turn to how the arbitrage and replication concepts introduced earlier for forward commitments differ when applied to contingent claims with an asymmetric payoff profile. Finally, we identify and describe factors that determine the value of an option. These lessons focus on European options, which can be exercised only at expiration.

Summary

- An option's value includes its exercise value and its time value. The exercise value is the option's value if it were *immediately* exercisable, whereas the time value captures the *possibility* that the passage of time and the variability of the underlying price will increase the profitability of exercise at maturity.
- Option moneyness expresses the relationship between the underlying price and the exercise price. A put–call option is "at the money" when the underlying price equals the exercise price. An option is more likely to be exercised if it is "in the money"—with an underlying price above (for a call) or below (for a put) the exercise price—and is less likely to be exercised if it is "out of the money."

- Because of their asymmetric payoff profile, options are characterized by no-arbitrage price bounds. The lower bound is a function of the present value of the exercise price and the underlying price, whereas the upper bound is the underlying price for a call and the exercise price for a put.
- As in the case of forward commitments, the replication of option contracts uses a combination of long (for a call) or short (for a put) positions in an underlying asset and borrowing or lending cash. The replicating transaction for an option is based on a proportion of the underlying, which is closely associated with the moneyness of the option.
- The underlying price, the exercise price, the time to maturity, the risk-free rate, the volatility of the underlying price, and any income or cost associated with owning the underlying asset are key factors in determining the value of an option.
- Changes in the volatility of the underlying price and the time to expiration usually will have the same directional effect on put and call option values. Changes to the exercise price, the risk-free rate, and any income or cost associated with owning the underlying asset have the opposite effect on call options versus put options.

Option Replication Using Put–Call Parity

- Level I
- 0.5 PL Credits
- Access the full reading: cfainst.is/putcall

Learning Outcomes

The member should be able to:

- explain put–call parity for European options, and
- explain put–call forward parity for European options.

Introduction

Previous lessons examined the payoff and profit profiles of call options and put options, the upper and lower bounds of an option's value, and the factors impacting option values. In doing so, we contrasted the asymmetry of one-sided option payoffs with the linear or symmetric payoff of forwards and underlying assets.

We now extend this analysis to show how to combine options to have an equivalent payoff to that of the underlying and a risk-free asset as well as a forward commitment. In the first lesson, we

demonstrate that the value of a European call may be used to derive the value of a European put option with the same underlying details, and vice versa, under a no-arbitrage condition referred to as put–call parity. In the second lesson, we show how this may be extended to forward commitments and how the put–call parity relationship may be applied to option and other investment strategies. We will focus on European options on underlying assets with no income or benefit.

Summary

- Put–call parity establishes a relationship that allows the price of a call option to be derived from the price of a put option with the same underlying details and vice versa.
- Put–call parity holds for European options with the same exercise price and expiration date, representing a no-arbitrage relationship between put option, call option, underlying asset, and risk-free asset prices.
- If put–call parity does not hold, then riskless arbitrage profit opportunities may be available to investors.
- Put–call forward parity extends the put–call parity relationship to forward contracts given the equivalence of an underlying asset position and a long forward contract plus a risk-free bond.
- Under put–call forward parity, we may demonstrate that a purchased put option and a sold call option are equivalent to a long risk-free bond and short forward position, and a sold put and purchased call are equivalent to a long forward and short risk-free bond.

- Put–call parity may be applied beyond option-based strategies in finance—for example, to demonstrate that equityholders have a position equivalent to a purchased call option on the value of the firm with unlimited upside, while debtholders have a sold put option position on firm value with limited upside.

Valuing a Derivative Using a One-Period Binomial Model

- Level I
- 0.75 PL Credits
- Access the full reading: cfainst.is/binomial

Learning Outcomes

The member should be able to:

- explain how to value a derivative using a one-period binomial model, and
- describe the concept of risk neutrality in derivatives pricing.

Introduction

Earlier lessons explained how the principle of no arbitrage and replication can be used to value and price derivatives. The put–call parity relationship linked put option, call option, underlying asset, and risk-free asset prices. This relationship was extended to forward contracts given the equivalence of an underlying asset position and a long forward contract plus a risk-free bond.

Forward commitments can be priced without making assumptions about the underlying asset's price in the future. However, the pricing of options and other contingent claims requires a model for the evolution of the underlying asset's future price. The first lesson introduces the widely used binomial model to value European put and call options. A simple one-period version is introduced, which may be extended to multiple periods and used to value more complex contingent claims. In the second lesson, we demonstrate the use of risk-neutral probabilities in derivatives pricing.

Summary

- The one-period binomial model values contingent claims, such as options, and assumes the underlying asset will either increase by R^u (up gross return) or decrease by R^d (down gross return) over a single period that corresponds to the expiration of the derivative contract.
- The binomial model combines an option with the underlying asset to create a risk-free portfolio in which the proportion of the option to the underlying security is determined by a hedge ratio.
- The hedged portfolio must earn the prevailing risk-free rate of return; otherwise, riskless arbitrage profit opportunities would be available.
- Valuing a derivative through risk-free hedging is equivalent to computing the discounted expected payoff of the option using risk-neutral probabilities rather than actual probabilities.

- Neither the actual (real-world) probabilities of underlying price increases or decreases nor the expected return of the underlying are required to price an option.
- The one-period binomial model can be extended to multiple periods as well to value more complex contingent claims.

Economics

Reading

Reading	Level	PL Credits	Link
Introduction to Geopolitics	I	1.5	cfainst.is/geopolitics

What Is Changing in the 2023 Curriculum, and Why Does It Matter?

There is no shortage of ways in which geopolitical risk can affect a portfolio. Some investment firms employ analysts whose principal job is to study how individuals, organizations, companies, and governments carry out political, economic, and financial activities—and how they interact with one another. The relationships among these various actors matter to analysts because they contribute to key drivers of investment performance—including economic growth, business performance, market volatility, and transaction costs. These relationships matter all the more at a time of heightened geopolitical risk, which affects the peaceful course of international relations.

The brand new "**Introduction to Geopolitics"** reading provides a structure for thinking about a wide range of geopolitical issues, ranging from changes in policy to natural disasters, terrorist acts, and, of course, war. This reading explains the difficulties of identifying, assessing, and tracking geopolitical risk. A helpful framework is presented that is designed to match potential risks to tangible investment outcomes. Using this framework, investors can better measure, assess, track, and react to geopolitical risk, with the goal of improving portfolios.

Introduction to Geopolitics

- Level I
- 1.5 PL Credits
- Access the full reading: cfainst.is/geopolitics

Learning Outcomes

The member should be able to:

- describe geopolitics from a cooperation versus competition perspective,
- describe geopolitics and its relationship with globalization,
- describe tools of geopolitics and their impact on regions and economies, and
- describe geopolitical risk and its impact on investments.

Introduction

The international environment is constantly evolving. Such trends as the growth of emerging market economies, globalization, and the rise of populism affect the range of opportunities and threats that companies, industries, nations, and regional groups face. They can

be affected by changes in regulation, disrupted trade flows, and even conflict.

Geopolitics is the study of how geography affects politics and international relations. Within the field of geopolitics, analysts study actors—the individuals, organizations, companies, and national governments that carry out political, economic, and financial activities—and how they interact with one another. These relations matter for investments because they contribute to important drivers of investment performance, including economic growth, business performance, market volatility, and transaction costs.

Geopolitical risk is the risk associated with tensions or actions between actors that affect the normal and peaceful course of international relations. Geopolitical risk tends to rise when the geographic and political factors underpinning country relations shift. A shift could arise from a change in policy, a natural disaster, a terrorist act, a theft, or war.

Investors study geopolitical risk because it has a tangible impact on investment outcomes. At the macroeconomic level, these risks affect capital markets conditions, including economic growth, interest rates, and market volatility. Changes in capital markets conditions, in turn, can have an important influence on asset allocation decisions, including an investor's choice of geographic exposure. At the portfolio level, geopolitical risk can influence the appropriateness of an investment security or strategy for an investor's goals, risk tolerance, and time horizon. A higher likelihood of geopolitical risk can raise or lower an asset class's expected return or have an impact on a sector's or a company's operating environment, affecting its attractiveness for an investment strategy.

There is no shortage of ways in which geopolitical risk can affect a portfolio, so identifying, assessing, and tracking geopolitical risk can be difficult and time consuming. It is important for investors to map these potential risks to tangible investment outcomes.

In this reading, we build a framework by which investors can measure, assess, track, and react to geopolitical risk, with a goal of improving investment outcomes.

Summary

- Geopolitics is the study of how geography affects politics and international relations. Within the field of geopolitics, analysts study actors—the individuals, organizations, companies, and national governments that carry out political, economic, and financial activities—and how they interact with one another.
- State actors can be cooperative or noncooperative. A country may want to cooperate with its neighbors or with other state actors for many reasons, which typically are defined according to a country's national interest.
- National security or national defense involves protecting a country, its citizens, economy, and institutions, from external threats. These threats may be broad in nature—ranging from military attack and terrorism, to crime, cyber-security, and even natural disasters.
- Geographic factors play an important role in shaping a country's approach to national security and the extent to which it will choose a cooperative approach. Landlocked countries rely extensively on their neighbors for access to vital resources. Countries highly connected to trade routes or countries acting as a conduit for trade may use their geographic location as a lever of power.
- Generally, strong institutions contribute to more stable internal and external political forces. Countries with strong institutions,

including organizations and structures promoting government accountability, rule of law, and property rights, allow them to act with more authority.

- Globalization is marked by economic and financial cooperation, including the active trade of goods and services, capital flows, currency exchange, and cultural and information exchange. Conversely, antiglobalization or nationalism is the promotion of a country's economic interests to the exclusion or detriment of the interests of other nations. Nationalism is marked by limited economic and financial cooperation.
- Globalization provides potential gains, such as:
  - increased profits—through increasing sales and/or reducing costs,
  - access to resources—market access and investment opportunities, and
  - intrinsic gains—an improved quality of life.
- Globalization also has some potential drawbacks, such as:
  - unequal economic and financial gains,
  - interdependence that can lead to supply chain disruption, and
  - possible exploitation of social and environmental resources.
- In general terms, regions, countries, and industries that are more dependent on cross-border goods and capital flows will have higher levels of cooperation.
- The interdependent nature of globalization may reduce the likelihood that collaborative countries levy economic, financial, or

political attacks on one another. Interdependence, however, can make cooperative actors more vulnerable to geopolitical risk than those that are less dependent on cooperation and trade.

- A geopolitical framework for analysis includes four archetypes of country behavior: autarky, hegemony, multilateralism, and bilateralism. Each archetype has its own costs, benefits, and tradeoffs with respect to geopolitical risk.
- The tools of geopolitics may be separated into three types:
  - national security tools,
  - economic tools, and
  - financial tools.
- The most extreme example of a national security tool is that of armed conflict. Espionage is an indirect national security tool. Military alliances often are used either to aid in direct conflict or to deter conflict from arising in the first place.
- Economic tools are used to reinforce a cooperative or noncooperative stance through economic means. Among state actors, economic tools can include multilateral trade agreements or the global harmonization of tariff rules. Economic tools also can be noncooperative in nature. Nationalization is a noncooperative approach to asserting economic control.
- Financial tools are the actions used to reinforce a cooperative or noncooperative stance through financial mechanisms. Examples of cooperative financial tools include the free exchange of currencies across borders and allowing foreign investment. Examples of noncooperative financial tools include limiting access to local currency markets and restricting foreign investment.

- Geopolitical risk is the risk associated with tensions or actions between actors (state and nonstate) that affect the normal and peaceful course of international relations. Geopolitical risk tends to rise when the geographic and political factors underpinning country relations shift.
- The three basic types of geopolitical risk are as follows:
  - event risk,
  - exogenous risk, and
  - thematic risk.
- Event risk evolves around set dates known in advance. Political events, for example, often result in changes to investor expectations related to a country's cooperative stance. Brexit is an example of event risk.
- Exogenous risk is a sudden or unanticipated risk that can affect either a country's cooperative stance, the ability of nonstate actors to globalize, or both. Examples include sudden uprisings, invasions, or the aftermath of natural disasters.
- Thematic risks are known risks that evolve and expand over a period of time. Climate change, cyber threats, and the ongoing threat of terrorism fall into this category.
- To make an assessment, an investor considers geopolitical risk in terms of the following three areas:
  - likelihood it will occur,
  - velocity (speed) of its impact, and
  - size and nature of that impact.

- Geopolitical risks seldom develop in linear fashion, making it difficult to monitor and forecast their likelihood, velocity, and size and nature of impact on a portfolio. As a result, many investors deploy an approach that includes scenario building and signposting rather than a single-point forecast.
- Scenario analysis is the process of evaluating portfolio outcomes across potential circumstances or states of the world. Scenarios can take the form of qualitative analysis, quantitative measurement, or both.
- Investors study geopolitical risk because it has a tangible impact on investment outcomes. On a macroeconomic level, these risks can affect capital market conditions, such as economic growth, interest rates, and market volatility.
- Changes in capital markets conditions can have an important influence on asset allocation decisions, including an investor's choice of geographic exposures.
- At the portfolio level, geopolitical risk can influence the appropriateness of an investment security or strategy for an investor's goals, risk tolerance, and time horizon.

Corporate Issuers

Readings

Reading	Level	PL Credits	Link
Corporate Structures and Ownership	I	1.25	cfainst.is/corpstructures
Introduction to Corporate Governance and Other ESG Considerations	I	1.5	cfainst.is/corpgovandesg
Business Models & Risks	I	1.25	cfainst.is/businessmodels
Capital Investments	I	1	cfainst.is/capital-investments
Working Capital & Liquidity	I	1	cfainst.is/workingcapital
Capital Structure	I	1.75	cfainst.is/capitalstructure
Financial Statement Modeling	II	4.5	cfainst.is/modeling
Cost of Capital: Advanced Topics	II	1.75	cfainst.is/costofcapital
Corporate Restructuring	II	2.25	cfainst.is/corprestructuring

What Is Changing in the 2023 Curriculum, and Why Does It Matter?

A new reading sets out the organizational forms used throughout the curriculum, with an emphasis on corporate structure, but also features the general partnership (GP) and limited partnership (LPs) structures used primarily for alternative investments. Through the prism of Tesla, and how the car company was co-founded and then taken over by Elon Musk, the "**Corporate Structures and Ownership**" reading shows how a corporate structure can evolve over time. A company may, as with Tesla, be founded by serial entrepreneurs who lack the skills to manage the business as it grows and requires ever larger amounts of capital. This reading shows how such companies professionalize to raise capital and attract investors. It also shows how analysts compare the financial claims and motivations of lenders and owners. The section on GP and LP relationships and interactions is key to understanding the structure and risks of many alternative investment vehicles.

Investor interest in sustainable investing has led to increased corporate disclosures of ESG activities and to a whole new industry that collects and analyzes ESG data. Refinements in the identification and analysis of ESG factors, as well as increased corporate disclosures, have resulted in increasingly quantifiable ESG information that can be used alongside financial information to value a company. The "**Introduction to Corporate Governance and Other ESG Considerations**" reading has been updated to describe new ESG disclosure requirements for publicly traded companies. The reading

describes the range of nonfinancial information now available, typically including annual reports, proxy statements, disclosures on company websites, investor relations departments, and social media.

The types of business models and how they can be modeled by analysts have been added to the new "**Business Models & Risks"** reading. The reading also includes a new section on alternative business models and the risks associated with these models. An understanding of a company's business model enables analysts to identify key drivers of firm performance as well as key sources of risk to a company's performance and value. The reading explains why analysts should not rely on management's description of its business model but rather should develop their own understanding of key drivers and risks facing the firm.

A major revision to the "**Capital Investments**" reading examines capital budgeting from the point of view of an external investment analyst. The reading features a discussion of advantages and disadvantages of using net present value (NPV) and internal rate of return (IRR) to assess how well capital has been allocated. A company's investments are measured against the value created and potential changes in the share price. Common capital allocation pitfalls are presented.

Given that corporate disclosure of capital investments is typically at a high level and lacking in specifics, the evaluation of a company's capital investments is often challenging for analysts. This reading provides practical guidance for analysts to address this challenge.

Analysts need to assess whether a firm is operating at an optimal level of working capital and financed at the lowest possible cost. Excess levels of working capital can have a harmful effect on shareholder returns. At the same time, insufficient levels of working capital can harm a company if it cannot meet its short-term obligations, leading to product shortages, sales slowdowns, and, in the extreme, bankruptcy. Methods of financing working capital are compared in a

revised "**Working Capital & Liquidity**" reading. The reading delves into the short-term funding choices available to companies and the expected relationships between working capital, liquidity, and short-term funding needs. In particular, sources of primary and secondary liquidity and factors are explained, as well as how analysts can compare a company's liquidity position with that of peers.

An updated "**Capital Structure"** reading ties capital structure theory to the real world, making it more relevant for analysts. In theory, companies seek an optimal mix of equity and debt that minimizes the firm's weighted average cost of capital and maximizes company value. In reality, a range of practical considerations affect capital structure, leading to wide variations in capital structures among otherwise similar companies.

Furthermore, it is common to think of capital structure as the result of a conscious decision by management. As the reading explains, it is not always that simple. For example, financial distress can arise because a company's capital structure policy was too aggressive, or because operating results or prospects deteriorate unexpectedly. Analysts also need to watch for capital structure decisions that are not in the interests of other stakeholders, including debtholders, suppliers, customers, and employees.

The former "Industry and Company Analysis" reading has been significantly revised and renamed "**Financial Statement Modeling**" to reflect new content about how to conduct financial modeling with spreadsheets. The reading focuses on how spreadsheets can be used to analyze the most important drivers of a firm's performance to forecast its free cash flows and profitability. A section on behavioral biases in forecasting outlines five key biases that can adversely affect the modeling process and strategies to mitigate them.

A new reading focuses on how to estimate required rates of return for equities and fixed income as well as how to construct the weighted average cost of capital (WACC). The "**Cost of Capital:**

Advanced Topics" reading explains top-down and bottom-up factors that affect the cost of capital and compares methods to estimate the cost of debt. It explains historical and forward-looking approaches for estimating an equity risk premium and estimates the cost of debt or required return on equity for both public and private companies.

For analysts and investors, as explained in the reading, WACC is a critical input used in company valuation, but poses a challenging task for an analyst. Many different methods can be used and key assumptions must be made about the capital structure and the company's marginal tax rate.

The former "Mergers and Acquisitions" reading has been heavily revised to widen the topic to all types of corporate restructurings and how to model them. Renamed "**Corporate Restructuring**," this reading sets out types of corporate restructurings and issuers' motivations for pursuing them. The reading explains, with the aid of case studies, how to evaluate a corporate restructuring and proposes a three-step process that an investment analyst could deploy. The emphasis of the reading is on understanding how and why companies evolve over time, as well as how this evolution affects the financial modeling and forecasting process.

Corporate Structures and Ownership

- Level I
- 1.25 PL Credits
- Access the full reading: cfainst.is/corpstructures

Learning Outcomes

The member should be able to:

- compare business structures and describe key features of corporate issuers,
- compare public and private companies, and
- compare the financial claims and motivations of lenders and owners.

Introduction

In 1997, Martin Eberhard and Marc Tarpenning, an engineer and a computer scientist, started a company called NuvoMedia to make an electronic book reader they called the Rocket eBook, a precursor to the Kindle eBook popularized by Amazon. Three years after it was founded, NuvoMedia was sold for USD187 million.

Soon after, the two entrepreneurs formed a new company, this one focused on making electric cars. They named this company in honor of the inventor Nikola Tesla. Because this was a high-risk, capital-intensive endeavor, they used only some of their newfound wealth and sought other investors with expertise in electric vehicles and fundraising capabilities. Elon Musk, an entrepreneur with a shared vision in the commercialization of electric sports cars, joined the team.

In addition to making an initial investment of USD6.3 million in Tesla, Musk also helped raise more money from other venture capitalists. Due to conflicts that were not disclosed, Eberhard and Tarpenning resigned just before Tesla came out with its first vehicle, the Roadster, in 2008. Musk took over as CEO and led Tesla's initial public offering in 2010, which raised USD226 million.

In many ways, Tesla's story is typical of how businesses begin and succeed. They are often started by founders with significant knowledge or technical expertise but who may lack the skills required to manage a business as it grows larger. Capital is needed to fund growth and is initially raised through private channels. Private investors often get involved in the management of the company, especially if they have a large investment at stake. Eventually, even larger amounts of capital are required, and the company is acquired or taken public.

We examine different forms of business structures, focusing on corporations and the securities they issue to capital providers.

Summary

- Common forms of business structures include sole proprietorships, general and limited partnerships, and corporations.

- Sole proprietorships and partnerships are considered extensions of their owner or partner(s). This largely means that profits are taxed at the individual's personal rates and individuals are fully liable for all of the business's debts.
- Limited partnerships and corporations allow for the specialization of expertise in operator roles, in addition to the redistribution of risk and return sharing between owners, partners, and operators.
- The corporate form of business structure is preferred when capital requirements are greater than what could be raised through other business structures.
- A corporation is a legal entity separate and distinct from its owners. Owners have limited liability, meaning that only their investment is at risk of loss.
- Corporations raise capital by selling an ownership interest and by borrowing money. They issue stocks, or shares, to equity investors who are owners. Debt represents money borrowed from lenders. Long-term lenders are issued bonds.
- Nonprofit corporations are formed to promote a public benefit, religious benefit, or charitable mission. They do not have shareholders, they do not distribute dividends, and they generally do not pay taxes.
- For-profit corporations can be public or private.
- In many jurisdictions, corporate profits are taxed twice: once at the corporate level and again at the individual level when profits are distributed as dividends to the owners.
- Public corporations usually are listed on an exchange, and ownership is easily transferable.

- Private corporations are not listed on an exchange and, therefore, have no observable stock price, making their valuation more challenging. Transactions between buyers and sellers are negotiated privately, and ownership transfer is much more difficult.
- The market capitalization of a public company is equal to share price multiplied by the number of shares outstanding.
- Enterprise value represents the total value of the company and is equal to the sum of the market capitalization and the market value of net debt. (Net debt is debt less cash.)
- Public companies are subject to greater regulatory and disclosure requirements—most notably, the public disclosure of financial information through periodic filings with their regulator. Private companies are not required to make such disclosures to the public.
- Given greater risks, only accredited investors are permitted to invest in private companies.
- Corporations have a life cycle with four distinct stages: start-up, growth, maturity, and decline.
- Although corporations begin as private companies, many eventually choose to go public or are acquired by public companies. Initial public offerings (IPOs) typically occur in the growth phase and usually are driven by capital needs to fund growth.
- In many industrial countries, it has become easier for private companies to access the capital they need without having to go public. As a result, the number of listed (public) companies in industrial countries has been trending downward. The number of listed companies in emerging economies continues to grow.

- Debt (bonds) represents a contractual obligation on the part of the issuing company. The corporation is obligated to make the promised interest payments to the debtholders and to return the principal. Equity (stock) does not involve a contractual obligation.
- Interest payments on debt are typically a tax-deductible expense for the corporation. Dividend payments on equity are not tax deductible.
- Debtholders have claim priority, but they are entitled only to the interest payments and the return of principal. Equityholders have no priority in claims.
- Therefore, from the investor's perspective, investing in equity is riskier than investing in debt. Equityholders do have a residual claim, meaning that they are entitled to whatever firm value remains after paying off the priority claim holders, which grants them unlimited upside potential.
- From the corporation's perspective, issuing debt is riskier than issuing equity. A corporation that cannot meet its contractual obligations to the debtholders can be forced into bankruptcy and liquidation.
- Potential conflicts can occur between debtholders and equityholders. Debtholders would prefer the corporation to invest in safer projects that produce smaller, more certain cash flows that are large enough to service the debt. Equityholders would prefer riskier projects that have much larger return potential, which they do not share with the debtholders.

Introduction to Corporate Governance and Other ESG Considerations

- Level I
- 1.5 PL Credits
- Access the full reading: cfainst.is/corpgovandesg

Learning Outcomes

The member should be able to:

- describe a company's stakeholder groups and compare their interests;
- describe the principal–agent relationship and conflicts that may arise between stakeholder groups;
- describe corporate governance and mechanisms to manage stakeholder relationships and mitigate associated risks;
- describe both the potential risks of poor corporate governance and stakeholder management and the benefits from effective corporate governance and stakeholder management;
- describe environmental, social, and governance (ESG) considerations in investment analysis; and
- describe ESG investment approaches.

Introduction

All companies operate in a complex ecosystem composed of interested stakeholder groups that are dependent on the company as well as each other for economic success. Key stakeholder groups include the company's capital providers, otherwise referred to as its debt- and equityholders. In addition, companies have a number of other interested parties.

These stakeholder groups do not necessarily share the same goals for, nor seek the same ends from, the company. The interests of any one stakeholder group may diverge or conflict with that of others and, in some cases, with the interests of the company itself. A company's ability to maximize long-term value for shareholders and generate sufficient profitability to make its debt obligations is compromised if one stakeholder group is able to consistently extract benefits to the detriment of another group. Therefore, the controls and mechanisms to harmonize and safeguard the interests of the company's stakeholders are key areas of both interest and risk for financial analysts.

Summary

The investment community is increasingly recognizing and quantifying environmental and social considerations and the impacts of corporate governance in the investment process. Analysts who understand these considerations can better evaluate their associated implications and risks for an investment decision. Following are the core concepts covered in this reading:

- The primary stakeholder groups of a corporation consist of shareholders, creditors, the board of directors, managers and employees, customers, suppliers, and government and regulators.

- A principal–agent relationship (or agency relationship) entails a principal hiring an agent to perform a particular task or service. In a company, both the board of directors and management act in an agent capacity to represent the interests of shareholder principals.
- Conflicts occur when the interests of various stakeholder groups diverge and when the interests of one group are compromised for the benefit of another.
- Stakeholder management involves identifying, prioritizing, and understanding the interests of stakeholder groups and managing the company's relationships with stakeholders.
- Mechanisms to mitigate shareholder risks include company reporting and transparency, general meetings, investor activism, derivative lawsuits, and corporate takeovers.
- Mechanisms to mitigate creditor risks include bond indenture(s), company reporting and transparency, and committee participation.
- Mechanisms to mitigate board risks include board or management meetings and board committees.
- Remaining mechanisms to mitigate risks for other stakeholder (employees, customers, suppliers, and regulators) include policies, laws, regulations, and codes.
- Executive (internal) directors are employed by the company and are typically members of senior management. Nonexecutive (external) directors have limited involvement in daily operations but serve an important oversight role.
- Two primary duties of a board of directors are duty of care and duty of loyalty.

- A company's board of directors typically has several committees that are responsible for specific functions and report to the board. Although the types of committees may vary across organization, the most common are the audit committee, governance committee, remuneration (compensation) committee, nomination committee, risk committee, and investment committee.
- Shareholder activism encompasses a range of strategies that may be used by shareholders when seeking to compel a company to act in a desired manner.
- From a corporation's perspective, risks of poor governance include weak control systems; ineffective decision making; and legal, regulatory, reputational, and default risk. Benefits include better operational efficiency, control, and operating and financial performance, as well as lower default risk (or cost of debt), which enhances shareholder value.
- Key analyst considerations in corporate governance and stakeholder management include economic ownership and voting control, board of directors' representation, remuneration and company performance, investor composition, strength of shareholders' rights, and the management of long-term risks.
- Environmental and social issues, such as climate change, air pollution, and societal impacts of a company's products and services, historically have been treated as negative externalities. Increased stakeholder awareness and strengthening regulations, however, are internalizing environmental and societal costs into the company's income statement by responsible investors.
- ESG investment approaches are *value* based or *values* based. The six common ESG investment approaches are negative screening, positive screening, ESG integration, thematic investing, engagement or active ownership, and impact investing.

Business Models & Risks

- Level I
- 1.25 PL Credits
- Access the full reading: cfainst.is/businessmodels

Learning Outcomes

The member should be able to:

- describe key features and types of business models;
- describe expected relations between a company's external environment, business model, and financing needs; and
- explain and classify types of business and financial risks for a company.

Introduction

A clearly described business model helps the analyst understand a business, including how it operates, its strategy, target customers, key partners, prospects, risks, and financial profile. Rather than rely on management's description of its business model, analysts should develop their own understanding.

Many firms have conventional business models that are easily understood and described in simple terms, such as manufacturer, wholesaler, retailer, professional firm, or restaurant chain. However, many business models are complex, specialized, or new. Digital technology, in particular, has enabled significant business model innovation, bringing business models into the spotlight. It has spawned new services and markets and has changed the way most businesses operate. In many cases, technology has enabled the disruption of existing business models, allowing new players to win against large and well-established players who lack the capabilities or agility to respond.

Summary

- A business model describes how a business is organized to deliver value to its customers:
  - who its customers are,
  - how the business serves them,
  - key assets and suppliers, and
  - the supporting business logic.
- The firm's "value proposition" refers to the product or service attributes valued by a firm's target customer that lead those customers to prefer a firm's offering over those of its competitors, given relative pricing.
- Channel strategy may be a key element of a business model, and it addresses how the firm is reaching its customers.
- Pricing is often a key element of the business model. Pricing approaches are typically value or cost based.

- In addition to the value proposition, a business model should address the "value chain" as well as "how" the firm is structured to deliver that value.
- Although many firms have conventional business models that are easily understood and described in simple terms, many business models are complex, specialized, or new.
- Digital technology has enabled significant business model innovation, often based on network effects.
- To understand the profitability of a business, the analyst should examine margins, break-even points, and "unit economics."
- Businesses have different financing needs and risk profiles, depending on both external and firm-specific factors, which will determine the firm's ability to raise capital.

Capital Investments

- Level I
- 1 PL Credit
- Access the full reading: cfainst.is/capitalinvestments

Learning Outcomes

The member should be able to:

- describe types of capital investments made by companies;
- describe the capital allocation process and basic principles of capital allocation;
- demonstrate the use of net present value (NPV) and internal rate of return (IRR) in allocating capital and describe the advantages and disadvantages of each method;
- describe common capital allocation pitfalls;
- describe expected relations among a company's investments, company value, and share price; and
- describe types of real options relevant to capital investment.

Introduction

Capital investments, also referred to as capital projects, are investments with a life of one year or longer made by corporate issuers.

Issuers make capital investments to generate value for their stakeholders by returning long-term benefits and future cash flows greater than the associated funding cost of the capital invested. How companies allocate capital between competing priorities and the resulting capital investment portfolio are central to a company's success and together constitute a fundamental area for analysts to understand. Given that corporate disclosure of capital investments typically is given at a very high level and often lacks specifics, the evaluation of a company's capital investments is often challenging for analysts.

Capital investments describe a company's future prospects better than its working capital or capital structure, which are often similar for companies, and provide insight into the quality of management's decisions and how the company is creating value for stakeholders. Although the focus of this coverage is on capital investments, companies also make other investments in increased working capital, information technology (IT), and human resources projects. These investments might not be capitalized and therefore affect near-term operating profit, but they are made for similar long-term benefit as capital investments.

Summary

Capital investments—those investments with a life of one year or longer—are key in determining whether a company is profitable and generating value for its shareholders. Capital allocation is the process companies use to decide their capital investment activity. This reading introduces capital investments, basic principles underlying the capital allocation model, and the use of NPV and IRR decision criteria.

- Companies invest for two reasons: to maintain their existing businesses and to grow them. Projects undertaken by companies to maintain a business including operating efficiencies are (1) going concern projects and (2) regulatory/compliance projects, while (3) expansion projects and (4) other projects are undertaken by companies to strategically expand or grow their operations.
- Capital allocation supports the most critical investments for many corporations—their investments in long-term assets. The principles of capital allocation are also relevant and can be applied to other corporate investing and financing decisions and to security analysis and portfolio management.
- The typical steps companies take in the capital allocation process are (1) idea generation, (2) investment analysis, (3) capital allocation planning, and (4) postaudit and monitoring.
- Companies should base their capital allocation decisions on the investment project's incremental after-tax cash flows discounted at the opportunity cost of funds. In addition, companies should ignore financing costs because both the cost of debt and the cost of other capital are captured in the discount rate used in the analysis.
- The NPV of an investment project is the present value of its after-tax cash flows (or the present value of its after-tax cash inflows minus the present value of its after-tax outflows) or

  $$\text{NPV} = \sum_{t=0}^{n} \frac{\text{CF}_t}{(1+r)^t},$$

  where the investment outlays are negative cash flows included in CF_t and r is the required rate of return for the investment.
- Microsoft Excel functions to solve for the NPV for both conventional and unconventional cash flow patterns are

  - NPV or =NPV(rate, values) and
  - XNPV or =XNPV(rate, values, dates),

  where "rate" is the discount rate, "values" are the cash flows, and "dates" are the dates of each of the cash flows.

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

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

- Using Microsoft Excel functions to solve for IRR, the functions are
  - IRR or =IRR(values, guess) and
  - XIRR or =XIRR(values, dates, guess),

  where "values" are the cash flows, "guess" is an optional user-specified guess that defaults to 10%, and "dates" are the dates of each cash flow.
- Companies should invest in a project if the NPV > 0 or if the IRR > r.
- For mutually exclusive investments that are ranked differently by the NPV and IRR, the NPV criterion is the more economically sound approach that companies should use.
- The fact that projects with positive NPVs theoretically increase the value of the company and the value of its stock could explain the use and popularity of the NPV method by companies.
- Real options allow companies to make future decisions contingent on future economic information or events that change the value of capital investment decisions the company has made

today. These can be classified as (1) timing options; (2) sizing options, which can be abandonment options or growth (expansion) options; (3) flexibility options, which can be price-setting options or production-flexibility options; and (4) fundamental options.

Working Capital & Liquidity

- Level I
- 1 PL Credit
- Access the full reading: cfainst.is/workingcapital

Learning Outcomes

The member should be able to:

- compare methods to finance working capital;
- explain expected relations between working capital, liquidity, and short-term funding needs;
- describe sources of primary and secondary liquidity and factors affecting a company's liquidity position;
- compare a company's liquidity position with that of peers; and
- evaluate short-term funding choices available to a company.

Introduction

Working capital (also called net working capital) is defined simply as current assets minus current liabilities:

(Net) Working capital = Current assets – Current liabilities

It includes both operating assets and liabilities, such as accounts receivable, accounts payable, and inventory, as well as financial assets and liabilities, such as short-term investments and short-term debt. Working capital management is the management of a firm's short-term assets and liabilities and an important aspect of a firm's operations. The goal of working capital management is to ensure the company has adequate, ready access to funds necessary for day-to-day operations, while avoiding excess reserves that can be a costly drag on the business' profitability and returns. Having excess levels of working capital can have a harmful effect on shareholder returns. At the same time, insufficient levels of working capital can harm a company if it cannot meet its short-term obligations, leading to product shortages, sales slowdowns, and, in the extreme, bankruptcy.

An analyst should carefully evaluate the working capital position of the firm to make an informed decision about the firm's ability to meet its short-term needs as it works to implement its long-term plans. To assess whether a firm is operating at an optimal level of working capital, financed at the lowest possible cost, an analyst should begin by asking two fundamental questions:

- What are the required investments in working capital for the firm?
- How should those investments be financed?

Understanding this provides the analyst with a basis for sound valuation analysis.

Summary

We consider key aspects of short-term financial management: the choices available to fund a company's working capital needs and

effective liquidity management. Both are critical in ensuring a company's day-to-day operations and ability to remain in business. Key points of coverage included the following:

- Internal and external sources available to finance working capital needs and considerations in their selection.
- Working capital approaches, their considerations, and their impact on the funding needs of the company.
- Primary and secondary sources of liquidity and factors that can enhance a company's liquidity position.
- The evaluation of a company's liquidity position and comparison to peers.
- The evaluation of short-term financing choices based on their characteristics and effective costs.

Capital Structure

- Level I
- 1.75 PL Credits
- Access the full reading: cfainst.is/capitalstructure

Learning Outcomes

The member should be able to:

- explain factors affecting capital structure;
- describe how a company's capital structure may change over its life cycle;
- explain the Modigliani–Miller propositions regarding capital structure;
- describe the use of target capital structure in estimating WACC, and calculate and interpret target capital structure weights; and
- describe competing stakeholder interests in capital structure decisions.

Introduction

Capital structure refers to the specific mix of debt and equity used to finance a company's assets and operations. From a corporate

perspective, equity represents a more expensive, permanent source of capital with greater financial flexibility. Financial flexibility allows a company to raise capital on reasonable terms when capital is needed. Conversely, debt represents a cheaper, finite-to-maturity capital source that legally obligates a company to make promised cash outflows on a fixed schedule with the need to refinance at some future date at an unknown cost.

As we will show, debt is an important component in the "optimal" capital structure. The trade-off theory of capital structure tells us that managers should seek an optimal mix of equity and debt that minimizes the firm's weighted average cost of capital, which in turn maximizes company value. That optimal capital structure represents a trade-off between the cost-effectiveness of borrowing relative to the higher cost of equity and the costs of financial distress.

In reality, many practical considerations affect capital structure and the use of leverage by companies, leading to wide variation in capital structures even among otherwise-similar companies. Practical considerations affecting capital structure include the following:

- *business characteristics:* features associated with a company's business model, operations, or maturity;
- *capital structure policies and leverage targets*: guidelines set by management and the board that seek to establish sensible borrowing limits for the company based on the company's risk appetite and ability to support debt; and
- *market conditions*: current share price levels and market interest rates for a company's debt. The prevalence of low interest rates increases the debt-carrying capacity of businesses and the use of debt by companies.

Because we are considering how a company minimizes its overall cost of capital, the focus is on the market values of debt and equity. Therefore, capital structure is also affected by changes in the market value of a company's securities over time.

We tend to think of capital structure as the result of a conscious decision by management, but it is not that simple. For example, unmanageable debt, or financial distress, can arise because a company's capital structure policy was too aggressive, but it also can occur because operating results or prospects deteriorate unexpectedly.

Finally, in seeking to maximize shareholder value, company management may make capital structure decisions that are not in the interests of other stakeholders, such as debtholders, suppliers, customers, or employees.

Summary

- Financing decisions typically are tied to investment spending and are based on the company's ability to support debt given the nature of its business model, assets, and operating cash flows.
- A company's stage in the life cycle, its cash flow characteristics, and its ability to support debt largely dictate its capital structure, because capital not sourced through borrowing must come from equity (including retained earnings).
- Generally speaking, as companies mature and move from start-up through growth to maturity, their business risk declines as operating cash flows turn positive with increasing predictability, allowing for greater use of leverage on more attractive terms.
- Modigliani and Miller's work, with its simplifying assumptions, provides a starting point for thinking about the strategic use of

debt and shows us that managers cannot change firm value simply by changing the firm's capital structure. Firm value is independent of capital structure decisions.

- Given the tax-deductibility of interest, adding leverage increases firm value up to a point but also increases the risk of default for capital providers who demand higher returns in compensation.
- To maximize firm value, management should target the optimal capital structure that minimizes the company's weighted average cost of capital.
- "Optimal capital structure" involves a trade-off between the benefits of higher leverage, which include the tax-deductibility of interest and the lower cost of debt relative to equity, and the costs of higher leverage, which include higher risk for all capital providers and the potential costs of financial distress.
- Managers may provide investors with information ("signaling") through their choice of financing method. For example, commitments to fixed payments may signal management's confidence in the company's prospects.
- Managers' capital structure decisions affect various stakeholder groups differently. In seeking to maximize shareholder wealth or their own, managers may create conflicts of interest in which one or more groups are favored at the expense of others, such as a debt-equity conflict.

Financial Statement Modeling

- Level II
- 4.5 PL Credits
- Access the full reading: cfainst.is/modeling

Learning Outcomes

The member should be able to:

- compare top-down, bottom-up, and hybrid approaches for developing inputs to equity valuation models;
- compare "growth relative to GDP growth" and "market growth and market share" approaches to forecasting revenue;
- evaluate whether economies of scale are present in an industry by analyzing operating margins and sales levels;
- demonstrate methods to forecast cost of goods sold and operating expenses;
- demonstrate methods to forecast nonoperating items, financing costs, and income taxes;
- describe approaches to balance sheet modeling;
- demonstrate the development of a sales-based pro forma company model;

- explain how behavioral factors affect analyst forecasts and recommend remedial actions for analyst biases;
- explain how competitive factors affect prices and costs;
- evaluate the competitive position of a company based on a Porter's five forces analysis;
- explain how to forecast industry and company sales and costs when they are subject to price inflation or deflation;
- evaluate the effects of technological developments on demand, selling prices, costs, and margins;
- explain considerations in the choice of an explicit forecast horizon; and
- explain an analyst's choices in developing projections beyond the short-term forecast horizon.

Introduction

Financial statement modeling is a key step in the process of valuing companies and the securities they have issued. We focus on how analysts use industry information and corporate disclosures to forecast a company's future financial results.

An effective financial statement model must be based on a thorough understanding of a company's business, management, strategy, external environment, and historical results. Thus, an analyst begins with a review of the company and its environment—its industry, key products, strategic position, management, competitors, suppliers, and customers. Using this information, an analyst identifies key

revenue and cost drivers and assesses the likely impact of relevant trends, such as economic conditions and technological developments. An analyst's understanding of the fundamental drivers of the business and assessment of future events provide the basis for forecast model inputs. In other words, financial statement modeling is not merely a quantitative or accounting exercise, it is the quantitative expression of an analyst's expectations for a company and its competitive environment.

We begin our discussion with an overview of developing a revenue forecast. We then describe the general approach to forecasting each of the financial statements and demonstrate the construction of a financial statement model, including forecasted revenue, income statements, balance sheets, and statements of cash flows. Then, we describe five key behavioral biases that influence the modeling process and strategies to mitigate them. We turn to several important topics on the effects of micro- and macroeconomic conditions on financial statement models: the impact of competitive factors on prices and costs, the effects of inflation and deflation, technological developments, and long-term forecasting considerations. The reading concludes with a summary.

Most of the examples and exhibits used throughout the reading can be downloaded as a Microsoft Excel workbook. Each worksheet in the workbook is labeled with the corresponding example or exhibit number in the text.

Summary

Industry and company analysis are essential tools of fundamental analysis. The key points include the following:

- Analysts can use a top-down, bottom-up, or hybrid approach to forecasting income and expenses. Top-down approaches usually begin at the level of the overall economy. Bottom-up approaches begin at the level of the individual company or unit within the company (e.g., business segment). Time-series approaches are considered bottom-up, although time-series analysis can be a tool used in top-down approaches. Hybrid approaches include elements of top-down and bottom-up approaches.
- In a "growth relative to GDP growth" approach to forecasting revenue, the analyst forecasts the growth rate of nominal GDP and industry and company growth relative to GDP growth.
- In a "market growth and market share" approach to forecasting revenue, the analyst combines forecasts of growth in particular markets with forecasts of a company's market share in the individual markets.
- Operating margins that are positively correlated with sales provide evidence of economies of scale in an industry.
- Some balance sheet line items, such as retained earnings, flow directly from the income statement, whereas accounts receivable, accounts payable, and inventory are closely linked to income statement projections.
- A common way to model working capital accounts is to use efficiency ratios.
- Return on invested capital (ROIC), defined as net operating profit less adjusted taxes divided by the difference between operating assets and operating liabilities, is an after-tax measure of profitability. High and persistent levels of ROIC are often associated with having a competitive advantage.

- Competitive factors affect a company's ability to negotiate lower input prices with suppliers and to raise prices for products and services. Porter's five forces framework can be used as a basis for identifying such factors.
- Inflation (deflation) affects pricing strategy depending on industry structure, competitive forces, and the nature of consumer demand.
- When a technological development results in a new product that threatens to cannibalize demand for an existing product, a unit forecast for the new product combined with an expected cannibalization factor can be used to estimate the impact on future demand for the existing product.
- Factors influencing the choice of the explicit forecast horizon include the projected holding period, an investor's average portfolio turnover, the cyclicality of an industry, company-specific factors, and employer preferences.
- Key behavioral biases that influence analyst forecasts are overconfidence, illusion of control conservatism, representativeness, and confirmation bias.

Cost of Capital: Advanced Topics

- Level II
- 1.75 PL Credits
- Access the full reading: cfainst.is/costofcapital

Learning Outcomes

The member should be able to:

- explain top-down and bottom-up factors that impact the cost of capital,
- compare methods used to estimate the cost of debt,
- explain historical and forward-looking approaches to estimating an equity risk premium,
- compare methods used to estimate the required return on equity,
- estimate the cost of debt or required return on equity for a public company and a private company, and
- evaluate a company's capital structure and cost of capital relative to peers.

Introduction

A company's weighted average cost of capital (WACC) represents the cost of debt and equity capital used by the company to finance its assets. The cost of debt is the after-tax cost to the issuer of debt, based on the return that debt investors require to finance a company. The cost of equity represents the return that equity investors require to own a company, also referred to as the required rate of return on equity or the required return on equity.

A company's WACC is used by the company's internal decision makers to evaluate capital investments. For analysts and investors, it is a critical input used in company valuation. Equation (1) shows how a company's WACC is driven by the proportions, or weights (the w_i), of the different capital sources used in its capital structure, applied to the costs of each source (the r_i):

$$\text{WACC} = w_d r_d(1 - \text{t}) + w_p r_p + w_e r_e, \quad (1)$$

where d, p, and e denote debt, preferred equity, and common equity, respectively. These weights are all non-negative and sum to 1.0.

Determining a company's WACC is an important, albeit challenging, task for an analyst given the following:

- Many different methods can be used to calculate the costs of each source of capital; there is no single, "right" method.
- Assumptions are needed regarding long-term target capital structure, which might or might not be the current capital structure.
- The company's marginal tax rate must be estimated and might be different from its average or effective tax rate.

Estimating the cost of capital for a company thus involves numerous, sometimes complex, assumptions and choices, all of which affect the resulting investment conclusion.

Corporate Restructuring

- Level II
- 2.25 PL Credits
- Access the full reading: cfainst.is/corprestructuring

Learning Outcomes

The member should be able to:

- explain types of corporate restructurings and issuers' motivations for pursuing them;
- explain the initial evaluation of a corporate restructuring;
- demonstrate valuation methods for, and interpret valuations of, companies involved in corporate restructurings;
- demonstrate how corporate restructurings affect an issuer's earnings per share (EPS); net debt to earnings before interest, taxes, depreciation, and amortization (EBITDA) ratio; and weighted average cost of capital;
- evaluate corporate investment actions, including equity investments, joint ventures, and acquisitions;
- evaluate corporate divestment actions, including sales and spin-offs; and
- evaluate cost and balance sheet restructurings.

Introduction

Corporate issuers change over time. Although many changes are evolutionary, such as launching new products and expanding capacity, others involve more revolutionary changes to the legal and accounting structure of the issuer. The most well-known among these structural changes is acquisitions, in which one company buys another. Other well-known changes include divestitures and spin-offs, in which an issuer sells or separates a segment of its business. Common features among these changes are that they tend to attract significant press and analyst attention and their announcement is associated with increased securities trading volume.

This reading explains how to evaluate corporate restructurings from the perspective of an independent investment analyst. The discussion begins in Section 2 with an overview of corporate restructurings, including putting these events in the context of the corporate life cycle, and corporate issuers' motivations for pursuing them. Sections 3 and 4 feature a three-step process for evaluating corporate restructurings as an investment analyst. Sections 5–7 demonstrate the evaluation process with case studies for each major type of corporate restructuring. The reading concludes with a summary and practice problems.

Summary

- Corporate issuers seek to alter their destiny, as described by the corporate life cycle, by taking actions known as restructurings.
- Restructurings include investment actions that increase the size and scope of an issuer's business, divestment actions that

decrease size or scope, and restructuring actions that do not affect scope but improve performance.

- Investment actions include equity investments, joint ventures, and acquisitions. Investment actions are often made by issuers seeking growth, synergies, or undervalued targets.
- Divestment actions include sales and spin-offs and are made by issuers seeking to increase growth or profitability or reduce risk by shedding certain divisions and assets.
- Restructuring actions, including cost cutting, balance sheet restructurings, and reorganizations, do not change the size or scope of issuers but are aimed at improving returns on capital to historical or peer levels.
- The evaluation of a corporate restructuring is composed of four phases: initial evaluation, preliminary evaluation, modeling, and updating the investment thesis. The entire evaluation generally is done only for material restructurings.
- The initial evaluation of a corporate restructuring answers the following questions: What is happening? When is it happening? Is it material? And why is it happening?
- Materiality is defined by both size and fit. One rule of thumb for size is that large actions are those that are greater than 10% of an issuer's enterprise value (e.g., for an acquisition, consideration in excess of 10% of the acquirer's preannouncement enterprise value). Fit refers to the alignment between the action and an analyst's expectations for the issuer.
- The three common valuation methods for companies involved in corporate restructurings, during the preliminary valuation

phase of the evaluation, are comparable company, comparable transaction, and premium paid analysis.

- Corporate restructurings must be modeled on the financial statements based on the situational specifics. Estimated financial statements that include the effect of a restructuring are known as pro forma financial statements.
- The weighted average cost of capital for an issuer is determined by the weights of different capital types and the constituent costs of capital. The costs of capital are influenced by both bottom-up and top-down drivers. Bottom-up drivers include stability, profitability, leverage, and asset specificity. Corporate restructurings affect the cost of capital by affecting these drivers.

Alternative Investments

Readings

Reading	Level	PL Credits	Link
Categories, Characteristics, and Compensation Structures of Alternative Investments	I	0.75	cfainst.is/altcategories
Performance Calculation and Appraisal of Alternative Investments	I	0.75	cfainst.is/perfcalculation
Private Capital, Real Estate, Infrastructure, Natural Resources, and Hedge Funds	I	2.25	cfainst.is/alternatives
Overview of Types of Real Estate Investment	II	1.25	cfainst.is/realestate
Investments in Real Estate through Private Vehicles	II	0.75	cfainst.is/reprivatevehicles
Investments in Real Estate through Publicly Traded Securities	II	1.25	cfainst.is/resecurities

What Is Changing in the 2023 Curriculum, and Why Does It Matter?

One of the key features of alternative investments is that investing in them requires special skills and information. Investing in alternative assets requires an understanding of illiquidity, transacting on private markets, operating sophisticated investment strategies, and managing risk–return profiles that are considerably different from those of traditional long-only investments. The new "**Categories, Characteristics, and Compensation Structures of Alternative Investments**" reading provides insights into types and categories of alternative investments. It introduces key characteristics of direct investments, co-investments, and fund investments into alternatives. The reading also tackles the investment and compensation structures commonly used by alternative investment managers.

The challenges in calculating and interpreting returns from alternative investments, both before and after fees, is addressed in the new "**Performance Calculation and Appraisal of Alternative Investments**" reading. This reading examines why traditional risk and return measures—such as mean return, standard deviation of returns, and beta—may not provide an adequate picture of alternative investments' risk and return given the nature of these investments.

As this reading makes clear, evaluating returns from an alternative investment is not a purely quantitative, one-size-fits-all process, but it can be a subtle, qualitative exercise. Much of the nuance revolves around volatility, in addition to total net return. Conducting performance appraisal on alternative investments also can be

challenging when there is an asymmetric risk–return profile, limited portfolio transparency, illiquidity, product complexity, or complex fee structures.

The new "**Private Capital, Real Estate, Infrastructure, Natural Resources, and Hedge Funds**" reading refreshes learners about the key characteristics of these asset classes. The reading explains how private funds are bought and sold and how they affect public markets.

Given the strong growth in private assets in recent years, this reading assesses what has driven their growth. The expansion of the private debt market, for instance, has been largely driven by private lending funds filling the gap between borrowing demand and reduced lending supply from traditional lenders. Meanwhile, more infrastructure projects are being financed privately, with the increasing use of public–private partnerships (PPPs) by local, regional, and national governments.

Investor allocations to public and private real estate have increased significantly over the past 20 years. Three integrated modules—"**Overview of Types of Real Estate Investment**," "**Investments in Real Estate through Private Vehicles**," and "**Investments in Real Estate through Publicly Traded Securities**"—cover various topics in real estate. These replace and consolidate the material that appeared in the previous two real estate readings at this level. The modules describe the unique risk and diversification characteristics of real estate investments that distinguish real estate from other asset classes. As a series, the modules bring together the ways that both public and private real estate management operate and are managed. The content describes the due diligence process for real estate investments, explain which factors affect their value, and outline how real estate is used in portfolios. The material also discusses real estate investment indexes, including their construction and potential biases.

Categories, Characteristics, and Compensation Structures of Alternative Investments

- Level I
- 0.75 PL Credits
- Access the full reading: cfainst.is/altcategories

Learning Outcomes

The member should be able to:

- describe types and categories of alternative investments;
- describe characteristics of direct investment, co-investment, and fund investment methods for alternative investments; and
- describe investment and compensation structures commonly used in alternative investments.

Introduction

"Alternative investments" is a label applied to a disparate group of investments to distinguish them from "traditional investments"—that

is, investments in long-only, publicly traded investments in stocks, bonds, and cash. We can think about three major categories of alternative investments based on how they differ from "traditional investments":

- private capital
- real assets
- hedge funds

One of the key features of alternative investments is that investing in them requires special skills and information. Investing in alternative assets can require handling illiquidity, transacting on private markets, operating sophisticated investment strategies, or risk–return profiles that are different from those of traditional long-only investments.

Why Investors Consider Alternative Investments

Alternative investments offer a variety of advantages:

- broader diversification through accessing a larger universe of investments or because of their lower correlation with traditional asset classes;
- opportunities for enhanced returns by improving the portfolio's risk–return profile; and
- potentially increased returns through higher yields, particularly compared with traditional investments in low–interest rate periods.

The 2019 annual report for the Yale University endowment provides one institutional investor's reasoning for investing in alternatives:

> The heavy [75.2%] allocation to nontraditional asset classes stems from the diversifying power they provide to the portfolio as a whole. Alternative assets, by their very nature, tend to be less efficiently priced than traditional marketable securities, providing an opportunity to exploit market inefficiencies through active management. Today's portfolio has significantly higher expected returns and lower volatility than the 1989 portfolio.

This quote neatly illustrates the expected characteristics of alternative investments: diversifying power, higher expected returns, and illiquid and potentially less efficient markets. The quote also highlights the importance of having the willingness and the ability to take a long-term perspective. Endowments, pension funds, sovereign wealth funds, and even family offices allocate increasing portions of their portfolios to alternative investments seeking to benefit from diversification and return opportunities.

Alternative investments are not free of risk, of course, and their returns may be correlated with those of other investments, especially in periods of financial crisis. Over a long historical period, the average correlation of returns from alternative investments with those of traditional investments may be low, but in any particular period, the correlation can differ from the average. During periods of economic crisis, correlations among many assets (both alternative and traditional) can increase dramatically.

Alternative investments often have many of the following characteristics:

- narrow specialization of the investment managers,
- relatively low correlation of returns with those of traditional investments, and

- less regulation and less transparency than traditional investments.

As a result of these characteristics, alternative investments often exhibit the following:

- limited reliable historical risk and return data;
- unique legal and tax considerations;
- higher fees, often including performance or incentive fees;
- concentrated portfolios; and
- restrictions on redemptions (i.e., "lockups" and "gates").

Categories of Alternative Investments

Considering the variety of alternative investments, it is not surprising that consensus has not been reached on a definitive list of groups or categories. Considerable debate even surrounds the use of categories versus subcategories. For the purpose of this reading, we classify alternative investments three categories and several subcategories, as follows:

- Private Capital
  - Private Equity (PE)
  - Private Debt
- Real Assets
  - Real Estate
  - Infrastructure
  - Natural Resources

    - Commodities
    - Agricultural land and Timberland
- Hedge Funds

Summary

The following section provides an overview of the three main categories and their subcategories.

Private Capital

- **Private equity.** PE funds generally invest in companies, whether startups or established firms, that are not listed on a public exchange, or they invest in public companies with the intent to take them private. The majority of PE activity, by value, involves leveraged buyouts of established profitable and cash-generating companies with solid customer bases, proven products, and high-quality management.
- Venture capital funds, a specialized form of PE that typically involves investing in or providing financing to startup or early-stage companies with high growth potential, represent a small portion of the PE market by value.
- **Private debt.** Private debt largely encompasses debt provided to private entities. Forms of private debt include the following:
    - direct lending (private loans with no intermediary),
    - mezzanine loans (private subordinated debt),

- venture debt (private loans to startup or early-stage companies that may have little or negative cash flow), and
- distressed debt (debt extended to companies that are "distressed" because of such issues as bankruptcy or other complications with meeting debt obligations).

Real Assets

- **Real estate.** Real estate investments are made in buildings or land, either directly or indirectly. They include private commercial real estate equity (e.g., ownership of an office building) and private commercial real estate debt (e.g., directly issued loans or mortgages on commercial property). Securitization has broadened the definition of real estate investing to include public real estate equity (e.g., real estate investment trusts, or REITs) and public real estate debt (e.g., mortgage-backed securities).
- **Infrastructure.** Infrastructure assets are capital-intensive, long-lived real assets, such as airports, roads, dams, and schools, that are intended for public use and provide essential services. An increasingly common approach to infrastructure investing is a public–private partnership (PPP) approach, in which governments and private investors each have a stake. Infrastructure investments provide exposure to asset cash flows, but the asset generally returns to public authority ownership. Infrastructure can be thought of as "real estate for the public," with cash flows from landing rights and road tolls.
- **Natural resources**
  - **Commodities.** Commodity investments may take place in physical commodity products, such as grains, metals, and

crude oil, either through owning physical assets, using derivative products, or investing in businesses engaged in the exploration and production of physical commodities.

- **Agricultural land (or farmland).** Agricultural land involves the cultivation of livestock or plants, and agricultural land investing covers various strategies, including the purchase of farmland to lease it back to farmers or to receive a stream of income from the growth, harvest, and sale of crops (e.g., corn, cotton, wheat) or livestock (e.g., cattle).
- **Timberland.** Investing in timberland generally involves investing capital in natural forests or managed tree plantations to earn a return when the trees are harvested. Timberland involves a longer investment cycle than that of agriculture. Timberland investors often rely on various drivers, such as biological growth, to increase the value of the trees so the wood can be sold at favorable prices in the future.

- **Other.** Other "real asset" investments may include tangible assets, such as fine wine, art, antique furniture and automobiles, stamps, coins, and other collectibles, and intangible assets, such as patents and litigation actions. "Digital assets" are an emerging investment opportunity. Some include these assets in the "other" category. Since 2015, however, the Commodity Futures Trading Commission (CFTC) has defined digital assets as a "digital commodity" and regulates them accordingly.

Hedge Funds

- Hedge funds are private investment vehicles that manage portfolios of securities or derivative positions using a variety of

strategies. They may involve long and short positions and may be highly leveraged. Some hedge funds try to deliver investment performance that is independent of broader market performance. Although hedge funds may be invested entirely in traditional assets, these vehicles are considered alternative because of their specialized approach.

Performance Calculation and Appraisal of Alternative Investments

- Level I
- 0.75 PL credits
- Access the full reading: cfainst.is/perfcalculation

Learning Outcomes

The member should be able to:

- describe issues in performance appraisal of alternative investments, and
- calculate and interpret returns of alternative investments both before and after fees.

Introduction

Investors frequently look to alternative investments for diversification and a chance to earn relatively high returns on a risk-adjusted basis. Investors also value low correlation and a more risk-neutral source of alpha.

Evaluating an alternative investment can be a subtle, qualitative exercise—one that depends on the initial objectives of the investor—as opposed to a purely quantitative, one-size-fits-all exercise. Much of the nuance revolves around not only the total net return created by an alternative investment but also the path and volatility (drawdown risk) required to create the total return as well as how an alternative investment fits into and benefits a larger portfolio of assets—in other words, its portfolio-level correlation benefit.

The attraction to alternative investments is often focused on their expected returns, but investors often neglect to consider the atypical risks they present—risks we can examine on both a standalone and portfolio basis:

- limited transparency
- low portfolio liquidity
- high leverage and use of derivatives
- high product complexity
- mark-to-market issues, especially for specialized products
- limited redemption availability
- difficulty in manager selection and diversification
- high fees, which can have a nontrivial impact on performance

Summary

- Conducting performance appraisal on alternative investments can be challenging because these investments are often characterized by asymmetric risk–return profiles, limited portfolio

transparency, illiquidity, product complexity, and complex fee structures.

- Traditional risk and return measures (such as mean return, standard deviation of returns, and beta) may provide an inadequate picture of alternative investments' risk and return characteristics. Moreover, these measures may be unreliable or not representative of specific investments.
- A variety of ratios can be calculated to review the performance of alternative investments, including the Sharpe ratio, Sortino ratio, Calmar ratio, and mean adequacy ratio (MAR). The internal rate of return (IRR) and multiple on invested capital (MOIC) calculations are often used to evaluate private equity investments, and the cap rate is often used to evaluate real estate investments.
- Redemption rules, lockup periods, and timing differences in reporting can bring special challenges to performance appraisal of alternative investments.

Private Capital, Real Estate, Infrastructure, Natural Resources, and Hedge Funds

- Level I
- 2.25 PL Credits
- Access the full reading: cfainst.is/alternatives

Learning Outcomes

The member should be able to:

- explain investment characteristics of private equity,
- explain investment characteristics of private debt,
- explain investment characteristics of real estate,
- explain investment characteristics of infrastructure,
- explain investment characteristics of natural resources, and
- explain investment characteristics of hedge funds.

Introduction

Private capital is the broad term for funding provided to companies that is sourced neither from the public markets, such as from the sale of equities, bonds, and other securities on exchanges, nor from traditional institutional providers, such as a government or bank. Capital raised from sources other than public markets and traditional institutions and in the form of an equity investment is called private equity (PE). Similarly sourced capital extended to companies through a loan or other form of debt is referred to as private debt. Private capital relates to the entire capital structure, including PE and private debt.

Private capital largely consists of private investment funds and entities that invest in the equity or debt securities of privately held companies, real estate, or other assets. Many private investment firms have PE and private debt arms; however, these teams typically refrain from investing in the same assets or businesses to avoid overexposure to a single investment and to avoid the conflict of interest that arises from being invested in both the equity and debt of an issuer. Private investment firms, even those with private debt arms, typically are referred to as PE firms. Although PE is the largest component of private capital, PE as a comprehensive generic category is inaccurate because other forms of private alternative finance have grown considerably in size and popularity.

Summary

- Private capital is a broad term used for funding provided to companies sourced from neither the PE nor public debt markets.

Capital provided in the form of equity investments is called PE, whereas capital provided as a loan or other form of debt is called private debt.

- PE refers to investment in privately owned companies or in public companies intended to be taken private. Key PE investment strategies include leveraged buyouts (e.g., management buyouts [MBOs] and management buy-ins [MBIs]) and venture capital. Primary exit strategies include trade sale, initial public offerings (IPO), and recapitalization.
- Private debt refers to various forms of debt provided by investors to private entities. Key private debt strategies include direct lending, mezzanine debt, and venture debt. Private debt also includes specialized strategies, such as collateralized loan obligation (CLOs), unitranche debt, real estate debt, and infrastructure debt.

Overview of Types of Real Estate Investment

- Level II
- 1.25 PL Credits
- Access the full reading: cfainst.is/realestate

Learning Outcomes

The member should be able to:

- compare the characteristics, classifications, principal risks, and basic forms of public and private real estate investments;
- explain portfolio roles and economic value determinants of real estate investments;
- discuss commercial property types, including their distinctive investment characteristics;
- explain the due diligence process for both private and public equity real estate investments; and
- discuss real estate investment indexes, including their construction and potential biases.

Introduction

Real estate property is an asset class that plays a significant role in many investment portfolios and is an attractive source of current income. Investor allocations to public and private real estate have increased significantly over the last 20 years. Because of the distinct characteristics of real estate property, real estate investments tend to behave differently from other asset classes—such as stocks, bonds, and commodities—and thus have different risks and diversification benefits. Private real estate investments are further differentiated because the investments are not publicly traded and require analytic techniques different from those of publicly traded assets. Because of the lack of directly comparable transactions, an appraisal process is required to value real estate property. Many of the indexes and benchmarks used for private real estate also rely on appraisals. Because of this characteristic, they behave differently from indexes for publicly traded equities, such as the S&P 500, MSCI Europe, FTSE Asia Pacific, and many other regional and global indexes.

Summary

General Characteristics of Real Estate

- Real estate investments can occur in four basic forms: private equity (direct ownership), publicly traded equity (indirect ownership claim), private debt (direct mortgage lending), and publicly traded debt (securitized mortgages).
- Many motivations exist for investing in real estate income property. The key factors are current income, price appreciation, inflation hedge, diversification, and tax benefits.

- Adding equity real estate investments to a traditional portfolio will potentially have diversification benefits because of the less-than-perfect correlation of equity real estate returns with returns to stocks and bonds.
- If the income stream can be adjusted for inflation and real estate prices increase with inflation, then equity real estate investments may provide an inflation hedge.
- Debt investors in real estate expect to receive their return from promised cash flows and typically do not participate in any appreciation in value of the underlying real estate. Thus, debt investments in real estate are similar to other fixed-income investments, such as bonds.
- Regardless of the form of real estate investment, the value of the underlying real estate property can affect the performance of the investment with location being a critical factor in determining the value of a real estate property.
- Real estate property has some unique characteristics compared with other investment asset classes. These characteristics include heterogeneity and fixed location, high unit value, management intensiveness, high transaction costs, depreciation, sensitivity to the credit market, illiquidity, and difficulty of value and price determination.
- There are many different types of real estate properties in which to invest. The main commercial (income-producing) real estate property types are office, industrial and warehouse, retail, and multifamily. Other types of commercial properties typically are classified by their specific use.
- Certain risk factors are common to commercial property, but each property type is likely to have a different susceptibility to

these factors. The key risk factors that can affect commercial real estate include business condition, lead time for new development, excess supply, cost and availability of capital, unexpected inflation, demographics, lack of liquidity, environmental issues, availability of information, management expertise, and leverage.

- Location, lease structures, and economic factors—such as economic growth, population growth, employment growth, and consumer spending—affect the value of each property type.

Investments in Real Estate through Private Vehicles

- Level II
- 0.75 PL Credits
- Access the full reading: cfainst.is/reprivatevehicles

Learning Outcomes

The member should be able to:

- discuss the income, cost, and sales comparison approaches to valuing real estate properties;
- compare the direct capitalization and discounted cash flow valuation methods;
- estimate and interpret the inputs (e.g., net operating income, capitalization rate, and discount rate) to the direct capitalization and discounted cash flow valuation methods;
- calculate the value of a property using the direct capitalization and discounted cash flow valuation methods; and
- calculate and interpret financial ratios used to analyze and evaluate private real estate investments.

INTRODUCTION

Direct property ownership and investment through private vehicles has long been the preferred choice of institutional investors, including insurance companies, pension funds, sovereign wealth funds, foundations, endowments, and high-net-worth families and individuals. Investors consider private real estate for capital gain, income, tax benefits, and low correlation with other asset classes. Long-term investors expect to earn an illiquidity premium, as same-property transactions are relatively rare. Direct property ownership allows owners to decide where and when to invest and when to sell.

Summary

- Generally, three different valuation approaches are used by appraisers: income, cost, and sales comparison.
- The income approach includes direct capitalization and discounted cash flow methods. Both methods focus on net operating income as an input to the value of a property and indirectly or directly factor in expected growth.
- The cost approach estimates the value of a property based on adjusted replacement cost. This approach typically is used for unusual properties for which market comparables are difficult to obtain.
- The sales comparison approach estimates the value of a property based on what price comparable properties are selling for in the current market.
- When debt financing is used to purchase a property, additional ratios and returns calculated and interpreted by debt and equity investors include the loan-to-value ratio, the debt service coverage ratio, and leveraged and unleveraged internal rates of return.

Investments in Real Estate through Publicly Traded Securities

- Level II
- 1.25 PL Credits
- Access the full reading: cfainst.is/resecurities

Learning Outcomes

The member should be able to:

- discuss types of publicly traded real estate securities;
- justify the use of net asset value per share (NAVPS) in valuation of publicly traded real estate securities and estimate NAVPS based on forecasted cash net operating income;
- describe the use of funds from operations (FFO) and adjusted funds from operations (AFFO) in real estate investment trust (REIT) valuation;
- calculate and interpret the value of a REIT share using the net asset value, relative value (price-to-FFO and price-to-AFFO), and discounted cash flow approaches; and
- explain advantages and disadvantages of investing in real estate through publicly traded securities compared to private vehicles.

Introduction

Historically, real estate investing was reserved for the wealthy and for institutions. REITs were initially conceived of as a way for small investors to gain exposure to a professionally managed, diversified real estate portfolio. REITs were viewed as a type of (closed-end) mutual fund and income passthrough vehicle through which the portfolio manager would acquire attractively valued properties, occasionally sell fully valued properties, and distribute property earnings to the trust's investors. Legislation was passed in the United States in 1960 to authorize REITs, and the Netherlands followed suit in 1969. The US model and other types of tax-advantaged real estate investment vehicles have been adopted worldwide. The S&P 500 Index added REITs as a separate Global Industry Classification Standard sector in 2016.

REITs are held by individuals and institutions alike. As of October 2020, more than 35 countries have REITs or REIT-like structures and more are considering adopting similar vehicles.

Summary

- The principal types of publicly traded real estate securities include REITs, real estate operating companies (REOCs), and residential and commercial mortgage-backed securities (RMBS and CMBS).
- Compared with other publicly traded shares, REITs typically offer higher-than-average yields and greater stability of income and returns. They are amenable to a net asset value approach to

valuation because of the existence of active private markets for their real estate assets.

- Compared with REOCs, REITs offer higher yields and income tax exemptions but have less operating flexibility to invest in a broad range of real estate activities and less potential for growth from reinvesting their operating cash flows because of their high income-to-payout ratios.
- In assessing the investment merits of REITs, investors analyze the effects of trends in general economic activity, retail sales, job creation, population growth, and new supply and demand for specific types of space. Investors also pay particular attention to occupancies, leasing activity, rental rates, remaining lease terms, in-place rents compared with market rents, costs to maintain space and re-lease space, tenants' financial health and tenant concentration in the portfolio, financial leverage, debt maturities and costs, and the quality of management and governance.
- Analysts make adjustments to the historical cost-based financial statements of REITs and REOCs to obtain better measures of current income and net worth. The three principal figures they calculate and use are (1) funds from operations or accounting net earnings, excluding depreciation, deferred tax charges, and gains or losses on sales of property and debt restructuring; (2) adjusted funds from operations, or funds from operations adjusted to remove straight-line rent and to provide for maintenance-type capital expenditures and leasing costs, including leasing agents' commissions and tenants' improvement allowances; and (3) net asset value or the difference between a real estate company's asset and liability ranking before shareholders' equity, all valued at market values instead of accounting book values.

- REITs and some REOCs generally return a significant portion of their income to their investors as required by law and, as a result, tend to pay high dividends. Thus, dividend discount or discounted cash flow models for valuation also are applicable. These valuation approaches are applied in the same manner as they are for shares in other industries. Usually, investors use two- or three-step dividend discount models with near-term, intermediate-term, or long-term growth assumptions. In discounted cash flow models, investors often use intermediate-term cash flow projections and a terminal value based on historical cash flow multiples.

Portfolio Management

Reading

Reading	Level	PL Credits	Link
Fintech in Investment Management	I	1	cfainst.is/fintech

What Is Changing in the 2023 Curriculum, and Why Does It Matter?

The revised "**Fintech in Investment Management**" reading includes a new analysis of how blockchain is affecting the investment industry. This reading describes financial applications of distributed ledger technology (DLT), including how DLT is creating new ways to record, track, and store transactions for financial assets.

DLT could provide secure ways of tracking ownership of financial assets on a peer-to-peer (P2P) basis. By allowing P2P interactions—in which individuals or firms transact directly with each other without mediation by a third party—DLT reduces the need for financial intermediaries. DLT could bring efficiencies to post-trade and compliance processes through automation, smart contracts, and identity verification. The reading explores how DLT transactions work and how they can improve efficiency in the investment industry.

Fintech in Investment Management

- Level I
- 1 PL Credit
- Access the full reading: cfainst.is/fintech

Learning Outcomes

The member should be able to:

- describe fintech;
- describe Big Data, artificial intelligence (AI), and machine learning (ML);
- describe fintech applications to investment management; and
- describe financial applications of distributed ledger technology.

Introduction

The meeting of finance and technology, commonly known as fintech, is changing the landscape of investment management. Advancements include the use of Big Data, AI, and ML to evaluate investment

opportunities, optimize portfolios, and mitigate risks. These developments are affecting not only quantitative asset managers but also fundamental asset managers who make use of these tools and technologies to engage in hybrid forms of investment decision making.

Investment advisory services are undergoing changes with the growth of automated wealth advisers or "robo-advisers." Robo-advisers might assist investors without the intervention of a human adviser, or they might be used in combination with a human adviser. The desired outcome is the ability to provide tailored, actionable advice to investors with greater ease of access and at lower cost.

In the area of financial record keeping, blockchain and distributed ledger technology (DLT) are creating new ways to record, track, and store transactions for financial assets. An early example of this trend is the cryptocurrency bitcoin, but the technology is being considered in a broader set of applications.

This reading is divided into ten main sections, which together define fintech and outline some of its key areas of impact in the field of investment management. Section 1 explains the concept and areas of fintech. Sections 2 and 3 discuss Big Data, AI, and ML. Section 4 discusses data science, and Sections 5–8 provide applications of fintech to investment management. Sections 9 and 10 examine DLT. A summary of key points completes the reading.

Summary

- The term "fintech" refers to technological innovation in the design and delivery of financial services and products.

- Areas of fintech development include the analysis of large datasets, analytical techniques, automated trading, automated advice, and financial record keeping.
- Big Data is characterized by the three Vs—volume, velocity, and variety—and includes both traditional and nontraditional (or alternative) datasets.
- Among the main sources of alternative data are data generated by individuals, business processes, and sensors.
- AI computer systems are capable of performing tasks that traditionally required human intelligence at levels comparable (or superior) to those of human beings.
- ML seeks to extract knowledge from large amounts of data by "learning" from known examples and then generating structure or predictions. Simply put, ML algorithms aim to "find the pattern, apply the pattern." The main types of ML include supervised learning, unsupervised learning, and deep learning.
- Natural language processing (NLP) is an application of text analytics that uses insight into the structure of human language to analyze and interpret text- and voice-based data.
- Robo-advisory services are providing automated advisory services to increasing numbers of retail investors. Services include asset allocation, portfolio optimization, trade execution, rebalancing, and tax strategies.
- Big Data and ML techniques could provide insights into real-time and changing market circumstances to identify weakening or adverse trends in advance, allowing for improved risk management and investment decision making.

- Algorithmic traders use automated trading programs to determine when, where, and how to trade an order on the basis of specified rules and market conditions. Benefits include speed of executions, lower trading costs, and anonymity.
- Blockchain and DLT might offer a new way to store, record, and track financial assets on a secure, distributed basis. Applications include cryptocurrencies and tokenization. Additionally, DLT could bring efficiencies to post-trade and compliance processes through automation, smart contracts, and identity verification.

Quantitative Methods

Readings

Reading	Level	PL Credits	Link
Basics of Multiple Regression and Underlying Assumptions	II	0.75	cfainst.is/multipleregression
Evaluating Regression Model Fit and Interpreting Model Results	II	0.75	cfainst.is/regressionmodel
Model Misspecification	II	0.75	cfainst.is/modelmisspec
Extensions of Multiple Regression	II	1	cfainst.is/extensionsmr

What Is Changing in the 2023 Curriculum, and Why Does It Matter?

Multiple regression content has been divided into four learning modules and updated with investment-focused datasets.

The **"Basics of Multiple Regression and Underlying Assumptions"** module examines the role that multiple regression estimation can play in investment management. This module sets out the basic assumptions of multiple regression and provides an overall estimation process to arrive at a regression model that best characterizes the data. New content involves the role that scatterplots and residual plots play in validating a potential regression model as well as presenting code snippets in Python and R software used to estimate a regression model on a specific investment-related dataset.

The second module in the series, **"Evaluating Regression Model Fit and Interpreting Model Results"** augments standard goodness-of-fit measures with new coverage of their relation to analysis of variance (ANOVA) tables and a discussion of information criterion metrics that can be used to determine the most parsimonious models. Coverage on joint hypothesis tests of multiple regression coefficients is expanded using the concept of "restricted" versus "unrestricted" regression models and the use of *F*-tests to determine when joint restrictions are supported by the data.

The third multiple regression module, **"Model Misspecification,"** provides an enhanced and updated evaluation of the types of model misspecification an analyst might encounter. The focus is on the estimated regression residuals and their use in identifying omitted

variables, nonlinearities in functional form, and problems in scaling or pooling data inappropriately. Tests are provided for omitted variables, serial correlation, and heteroskedasticity along with guidance on how these tests can be interpreted. Multicollinearity—where explanatory variables are highly related to one another—is explained and the use of the variance inflation factor (VIF) in identifying these situations is provided.

"Extensions of Multiple Regression," the final module, examines three important extensions of the multiple regression model: (1) outliers and influential observations, (2) qualitative variables as explanatory variables, and (3) logit regression for qualitative dependent variables. Outliers and influential observations can have out-size impacts on regression estimates. New content on measures for identifying influential observations are provided along with a discussion of how an analyst can evaluate their impacts. Qualitative or dummy explanatory variables are used to capture categorical or qualitative data in a regression model. A visual discussion of their impacts on a regression model, testing of their significance and their use in characterizing mutual fund returns is provided. The final section looks at logistic regression, a fundamental tool in machine learning, which is useful when an analyst needs to explain a binary dependent variable, such as bankruptcy or an action taken or not. The within-module example looks at estimating the probability of whether or not a company undertakes a share repurchase based on certain characteristics.

Each module contains code snippets in Python and R to support the results presented. In addition, each module contains examples and end-of-reading practice problems that highlight the use of module content in an investment setting. Taken together, the readings show how an analyst specifies a model by answering key questions, such as the following: What is the dependent variable of interest? What independent variables are important? What form should the

model take? What is the goal of the model: prediction or an understanding of the relationship?

Multiple linear regression allows analysts to estimate using more complex models with multiple explanatory variables that, if used correctly, may lead to better predictions, better portfolio construction, and better understanding of the drivers of security returns. If used incorrectly, however, multiple linear regression may yield spurious relationships, lead to poor predictions, and offer a poor understanding of relationships. These modules explore the pitfalls and measures to mitigate these potential problems.

Basics of Multiple Regression and Underlying Assumptions

- Level II
- 0.75 PL Credits
- Access the full reading: cfainst.is/multipleregression

Learning Outcomes

The member should be able to:

- describe the types of investment problems addressed by multiple linear regression and the regression process;
- formulate a multiple linear regression model, describe the relation between the dependent variable and several independent variables, and interpret estimated regression coefficients; and
- explain the assumptions underlying a multiple linear regression model and interpret residual plots indicating potential violations of these assumptions.

Introduction

Multiple linear regression uses two or more independent variables to describe the variation of the dependent variable rather than just one independent variable, as in simple linear regression. It allows the analyst to estimate using more complex models with multiple explanatory variables and, if used correctly, may lead to better predictions, better portfolio construction, or better understanding of the drivers of security returns. If used incorrectly, however, multiple linear regression may yield spurious relationships, lead to poor predictions, and offer a poor understanding of relationships.

The analyst must first specify the model and make several decisions in this process. The analyst must answer the following questions: What is the dependent variable of interest? What independent variables are important? What form should the model take? What is the goal of the model—prediction or understanding of the relationship?

The analyst specifies the dependent and independent variables and then employs software to estimate the model and produce related statistics. The good news is that the software does the estimation (see Exhibit 1). The analyst's primary tasks are to specify the model and interpret the output from this software, which are the main subjects of this content.

Exhibit 1. Examples of Regression Software

Software	Programs/Functions
Excel	Data Analysis > Regression
Python	scipy.stats.linregress
	statsmodels.lm
	sklearn.linear_model.LinearRegression

Software	Programs/Functions
R	lm
SAS	PROC REG PROC GLM
STATA	regress

Summary

- Multiple linear regression is used to model the linear relationship between one dependent variable and two or more independent variables.
- In practice, multiple regressions are used to explain relationships between financial variables, to test existing theories, or to make forecasts.
- The regression process covers several decisions the analyst must make, such as identifying the dependent and independent variables, selecting the appropriate regression model, testing if the assumptions behind linear regression are satisfied, examining goodness of fit, and making needed adjustments.
- A multiple regression model is represented by the following equation:

  $$Y_i = b_0 + b_1X_{1i} + b_2X_{2i} + b_3X_{3i} + \ldots + b_kX_{ki} + \varepsilon_i,\ i = 1, 2, 3, \ldots, n,$$

  where Y is the dependent variable, Xs are the independent variables from 1 to k, and the model is estimated using n observations.

- Coefficient b_0 is the model's "intercept," representing the expected value of Y if all independent variables are zero.
- Parameters b_1 to b_k are the slope coefficients (or partial regression coefficients) for independent variables X_1 to X_k. Slope coefficient b_j describes the impact of independent variable X_j on Y, holding all the other independent variables constant.
- Five main assumptions underlying multiple regression models must be satisfied: (1) linearity, (2) homoskedasticity, (3) independence of errors, (4) normality, and (5) independence of independent variables.
- Diagnostic plots can help detect whether these assumptions are satisfied. Scatterplots of dependent versus and independent variables are useful for detecting nonlinear relationships, while residual plots are useful for detecting violations of homoskedasticity and independence of errors.

Evaluating Regression Model Fit and Interpreting Model Results

- Level II
- 0.75 PL Credits
- Access the full reading; cfainst.is/regressionmodel

Learning Outcomes

The member should be able to:

- evaluate how well a multiple regression model explains the dependent variable by analyzing analysis of variance (ANOVA) table results and measures of goodness of fit;
- formulate hypotheses on the significance of two or more coefficients in a multiple regression model and interpret the results of the joint hypothesis tests; and
- calculate and interpret a predicted value for the dependent variable, given the estimated regression model and assumed values for the independent variable.

Summary

- In multiple regression, adjusted R^2 is used as a measure of model goodness of fit because it does not automatically increase as independent variables are added to the model. Rather, it adjusts for the degrees of freedom by incorporating the number of independent variables.
- Adjusted R^2 will increase (decrease) if a variable is added to the model that has a coefficient with an absolute value of its t-statistic greater (less) than 1.0.
- Akaike's information criterion (AIC) and Schwarz's Bayesian information criteria (BIC) also are used to evaluate model fit and select the "best" model among a group with the same dependent variable. AIC is preferred if the purpose is prediction, whereas BIC is preferred if goodness of fit is the goal; lower values of both measures are better.
- Hypothesis tests of a single coefficient in a multiple regression, using *t*-tests, are identical to those in simple regression.
- The joint *F*-test is used to jointly test a subset of variables in a multiple regression, where the "restricted" model is based on a narrower set of independent variables nested in the broader "unrestricted" model. The null hypothesis is that the slope coefficients of all independent variables outside the restricted model are zero.
- The general linear *F*-test is an extension of the joint *F*-test, where the null hypothesis is that the slope coefficients on all independent variables in the unrestricted model are equal to zero.

- Predicting the value of the dependent variable using an estimated multiple regression model is similar to that in simple regression. First, sum, for each independent variable, the estimated slope coefficient multiplied by the assumed value of that variable, and then add the estimated intercept coefficient.
- In multiple regression, the confidence interval around the forecasted value of the dependent variable reflects both model error and sampling error (from forecasting the independent variables); the larger the sampling error, the larger is the standard error of the forecast of Y and the wider is the confidence interval.

Model Misspecification

- Level II
- 0.75 PL Credits
- Access the full reading: cfainst.is/modelmisspec

Learning Outcomes

The member should be able to:

- describe how model misspecification affects the results of a regression analysis and how to avoid common forms of misspecification;
- explain the types of heteroskedasticity and how it affects statistical inference;
- explain serial correlation and how it affects statistical inference; and
- explain multicollinearity and how it affects regression analysis.

Summary

- Principles for proper regression model specification include economic reasoning behind variable choices, parsimony, good

out-of-sample performance, appropriate model functional form, and no violations of regression assumptions.

- Failures in regression functional form typically are due to omitted variables, inappropriate form of variables, inappropriate variable scaling, and inappropriate data pooling; these may lead to the violations of regression assumptions.
- Heteroskedasticity occurs when the variance of regression errors differs across observations. Unconditional heteroskedasticity exists when the error variance is not correlated with the independent variables, whereas conditional heteroskedasticity exists when the error variance is correlated with the values of the independent variables.
- Unconditional heteroskedasticity creates no major problems for statistical inference, but conditional heteroskedasticity is problematic because it results in underestimation of the regression coefficients' standard errors, so *t*-statistics are inflated and Type I errors are more likely.
- Conditional heteroskedasticity can be detected using the Breusch–Pagan (BP) test, and the bias it creates in the regression model can be corrected by computing robust standard errors.
- Serial correlation (or autocorrelation) occurs when regression errors are correlated across observations and may be a serious problem in time-series regressions. Serial correlation can lead to inconsistent coefficient estimates, and it underestimates standard errors, so *t*-statistics are inflated (as with conditional heteroskedasticity).
- The Breusch–Godfrey (BG) test is a robust method for detecting serial correlation. The BG test uses residuals from the original regression as the dependent variables run against the initial

regressors plus the lagged residuals, and H_0 is the coefficient of the lagged residuals are zero.

- The biased estimates of standard errors caused by serial correlation can be corrected using robust standard errors, which also correct for conditional heteroskedasticity.
- Multicollinearity occurs with high pairwise correlations between independent variables or if three or more independent variables form approximate linear combinations that are highly correlated. Multicollinearity results in inflated standard errors and reduced *t*-statistics.
- The variance inflation factor (VIF) is a measure used to quantify multicollinearity. If $VIF_j = 1$ for X_j, then there is no correlation between X_j and the other regressors. $VIF_j > 5$ warrants further investigation, and $VIF_j > 10$ indicates serious multicollinearity requiring correction.
- Solutions to multicollinearity include dropping one or more of the regression variables, using a different proxy for one of the variables, or increasing the sample size.

Extensions of Multiple Regression

- Level II
- 1 PL Credit
- Access the full reading: cfainst.is/extensionsmr

Learning Outcomes

The member should be able to:

- describe influence analysis and methods of detecting influential data points;
- formulate and interpret a multiple regression model that includes qualitative independent variables; and
- formulate and interpret a logistic regression model.

Summary

- Two kinds of observations may potentially influence regression results: (1) a high leverage point, an observation with an extreme value of an independent variable; and (2) an outlier, an observation with an extreme value of the dependent variable.

- A measure for identifying a high-leverage point is leverage. If leverage is greater than $3\left(\frac{k+1}{n}\right)$ where k is the number of independent variables, then the observation is potentially influential. A measure for identifying an outlier is studentized residuals. If the studentized residual is greater than the critical value of the t-statistic with $n - k - 2$ degrees of freedom, then the observation is potentially influential.
- Cook's distance, or Cook's D (D_i), is a metric used to identify influential data points. It measures how much the estimated values of the regression change if observation i is deleted. If $D_i > 2\sqrt[2]{k/n}$ then it is highly likely to be influential. An influence plot visually presents leverage, studentized residuals, and Cook's D for each observation.
- Dummy, or indicator, variables represent qualitative independent variables and take a value of 1 (for true) or 0 (for false) to indicate whether a specific condition applies, such as whether a company belongs to a certain industry sector. To capture n possible categories, the model must include $n - 1$ dummy variables.
- An intercept dummy adds to or reduces the original intercept if a specific condition is met. When the intercept dummy is 1, the regression line shifts up or down parallel to the base regression line.
- A slope dummy allows for a changing slope if a specific condition is met. When the slope dummy is 1, the slope changes to $(d_j + b_j) \times X_j$, where d_j is the coefficient on the dummy variable and b_j is the slope of X_j in the original regression line.
- A logistic regression model is one with a qualitative (i.e., categorical) dependent variable, so logistic regression is often used in

binary classification problems, which are common in machine learning and neural networks.

- To estimate a logistic regression, the logistic transformation of the event probability (P) into the log odds, $\ln[P/(1 - P)]$, is applied, which linearizes the relationship between the transformed dependent variable and the independent variables.
- Logistic regression coefficients typically are estimated using the maximum likelihood estimation (MLE) method, and slope coefficients are interpreted as the change in the log odds that the event happens per unit change in the independent variable, holding all other independent variables constant.

Ethics

Reading

Reading	Level	PL Credits	Link
Application of the Code and Standards: Level II	II	1.5 PL/1.5 SER	cfainst.is/code-andstandardsl2

What Is Changing in the 2023 Curriculum, and Why Does It Matter?

The "**Application of the Code and Standards: Level II**" reading includes a new vignette illustrating how the CFA Institute Code of Ethics and Standards of Professional Conduct (the Code and Standards) can be applied to ensure professional and ethical judgment. The vignette centers on Serengeti Advisory Services (Serengeti), a hypothetical equity research firm based in Tanzania. The firm faces a variety of potential conflicts of interest with clients and must decide how to act.

The vignette, like others in the reading, helps investment industry professionals to focus on identifying when and how violations of the Code and Standards may have occurred. This reading includes considerable discussion and a rationale as to why or why not a violation might have taken place to guide professionals. The vignette illustrates how applying the framework might have helped each individual make decisions. By identifying where the Code and Standards might be relevant and considering actions and consequences within this framework, investment professionals can make ethically sound decisions.

Application of the Code and Standards: Level II

- Level II
- 1.5 PL/1.5 SER Credits
- Access the full reading: cfainst.is/codeandstandardsl2

Learning Outcomes

The member should be able to:

- evaluate practices, policies, and conduct relative to the CFA Institute Code of Ethics and Standards of Professional Conduct; and
- explain how the practices, policies, and conduct do or do not violate the CFA Institute Code of Ethics and Standards of Professional Conduct.

Introduction

This reading presents vignettes to illustrate how the CFA Institute Code of Ethics and Standards of Professional Conduct (the Code and Standards) can be applied in situations requiring professional and

ethical judgment. Exhibit 1 presents a useful framework to guide individuals in their ethical decision-making process and application of the Code and Standards. By identifying where the Code and Standards might be relevant and considering actions and consequences within this framework, individuals can make more ethically sound decisions.

Although the framework's components do not need to be addressed in the sequence shown, a review of the outcome should conclude the process. This review provides insights for improved decision making in the future.

Exhibit 1. A Framework for Ethical Decision Making

- Identify: Relevant facts, stakeholders and duties owed, ethical principles, conflicts of interest
- Consider: Situational influences, additional guidance, alternative actions
- Decide and act
- Reflect: Was the outcome as anticipated? Why or why not?

Summary

This reading presents a number of scenarios involving individuals in private and institutional asset management. The first five cases focus on identifying whether violations of the Code and Standards occurred, with discussion and rationale as to why or why not a

violation might have taken place. The last two cases focus on identifying violations of the Code and Standards, taking necessary corrective actions, and developing a policy statement to prevent future violations by a firm's employees. These cases illustrate how applying the framework might have helped each individual make decisions.