CFA Institute®
CFA Program

PRIVATE MARKETS PATHWAY

CFA® Program Curriculum
2025 • LEVEL III PRIVATE MARKETS PATHWAY • VOLUME 2

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How to Use the CFA Program Curriculum

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

- A broad outline that lists the major CFA Program topic areas (www.cfainstitute.org/programs/cfa/curriculum/cbok/cbok)
- Topic area weights that indicate the relative exam weightings of the top-level topic areas (www.cfainstitute.org/en/programs/cfa/curriculum)
- Learning outcome statements (LOS) that advise candidates about the specific knowledge, skills, and abilities they should acquire from curriculum content covering a topic area: LOS are provided at the beginning of each block of related content and the specific lesson that covers them. We encourage you to review the information about the LOS on our website (www.cfainstitute.org/programs/cfa/curriculum/study-sessions), including the descriptions of LOS "command words" on the candidate resources page at www.cfainstitute.org/-/media/documents/support/programs/cfa-and-cipm-los-command-words.ashx.
- The CFA Program curriculum that candidates receive access to upon exam registration

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The curriculum, including the practice questions, is the basis for all exam questions. The curriculum is selected or developed specifically to provide candidates with the knowledge, skills, and abilities reflected in the CBOK.

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DESIGNING YOUR PERSONAL STUDY PROGRAM

An orderly, systematic approach to exam preparation is critical. You should dedicate a consistent block of time every week to reading and studying. Review the LOS both before and after you study curriculum content to ensure you can demonstrate the

knowledge, skills, and abilities described by the LOS and the assigned reading. Use the LOS as a self-check to track your progress and highlight areas of weakness for later review.

Successful candidates report an average of more than 300 hours preparing for each exam. Your preparation time will vary based on your prior education and experience, and you will likely spend more time on some topics than on others.

ERRATA

The curriculum development process is rigorous and involves multiple rounds of reviews by content experts. Despite our efforts to produce a curriculum that is free of errors, in some instances, we must make corrections. Curriculum errata are periodically updated and posted by exam level and test date on the Curriculum Errata webpage (www.cfainstitute.org/en/programs/submit-errata). If you believe you have found an error in the curriculum, you can submit your concerns through our curriculum errata reporting process found at the bottom of the Curriculum Errata webpage.

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Please send any comments or suggestions to info@cfainstitute.org, and we will review your feedback thoughtfully.

Private Markets Pathway

LEARNING MODULE

5

Private Special Situations

LEARNING OUTCOMES

Mastery	*The candidate should be able to:*
☐	discuss the characteristics and risks of special investment situations
☐	discuss the features of distressed debt, financing alternatives for issuers in financial distress, and investment strategies in distressed situations
☐	discuss the features of complex investment situations involving financial dislocation or stress
☐	discuss the due diligence and valuation processes used to evaluate special investment situations
☐	discuss the risk and return among special situations and compared to other forms of private debt as part of a strategic asset allocation

INTRODUCTION

1

As described in earlier learning modules, private market strategies usually involve investments over a broad range of company life-cycle phases or project development stages with relatively long and illiquid holding periods. Private investment general partners (GPs) focus on adding value and generating returns over a multiyear investment life cycle in private equity, real estate, and infrastructure investments, among others.

Special situations investments, in contrast, are often of a shorter-term nature, focused on opportunities associated with events or market conditions that are expected to have a significant impact on the absolute or relative value of an issuer's private or public obligations. These events are most frequently associated with either financial dislocation or distress, although non-financial events such as fraud, litigation, or failed business combinations may be involved. This type of investment spans a wide range of corporate and sovereign issuers and investments, including private special situations funds, high-risk debt strategies within a private debt asset allocation, or as a separate category of opportunistic investments. Despite their investments in publicly traded securities in many cases, special situations funds are included here due to their predominantly private ownership structure. Given their episodic nature and limited scope, special situations represent a small but growing fraction of the overall private market universe. According to the alternative investment data provider Preqin, which includes such investments in its private debt category as either distressed debt

or special situations and mezzanine debt, these strategies are expected to reach over USD1 trillion in global assets under management (AUM) by 2027, or just under half of all private debt investments under management.

This learning module builds on the foundation established in the Private Debt learning module in this pathway by first addressing the features of special situations investments. While the previous learning module highlighted the use of debt in private market strategies over a restructuring or project development life cycle, the focus here is on *events* that materially affect the value of an issuer's debt or equity securities. For example, financial distress, or a high likelihood that promised loan or bond payments will not be made in full on time, and its resolution via restructuring, bankruptcy, or liquidation are among the most common events associated with this investment subcategory. We will address the characteristics of distressed debt, which arise due to both adverse macroeconomic conditions and company- and industry-specific factors, as well as financing alternatives for distressed issuers. Investment approaches associated with special situations include short-term trading strategies related to credit events or business combinations, more active strategies seeking to control a firm as it emerges from bankruptcy, and more complex transactions involving capital structure or convertible arbitrage. As with other private markets, specialized GP knowledge and experience are critical to success in sourcing, evaluating, and executing special situations investments, which often include an understanding of the bankruptcy process. Valuation approaches are often supported by scenario analysis given the material impact of alternative outcomes. The combination of returns dominated by short-term price changes and the potential for less correlation and idiosyncratic sources of return are important drivers of the unique role of special situations in a strategic asset allocation.

LEARNING MODULE OVERVIEW

- Special situations involve opportunities associated with issuers in financial distress or events over a relatively short time horizon. Strategies include capitalizing on securities mispricing for distressed issuers, a corporate action such as a merger or acquisition, or a more complex investment situation, such as convertible arbitrage.
- Distressed debt involves issuers that are illiquid, insolvent, or at greater risk of not meeting debt obligations. Distressed financing alternatives include debt exchanges outside or within the bankruptcy process, as well as secured debtor-in-possession financing during the reorganization period.
- Structural models linking the price of equity and credit may be used to establish relative value across a firm's shares, bonds, and credit default swap (CDS) pricing. Capital structure and convertible arbitrage strategies seek to capitalize on pricing anomalies among these positions and within the capital structure in cases of financial dislocation.
- Investors in special situations often face a short time frame to conduct due diligence and have less information, which is subject to event-driven change. Given the challenges of incorporating the timing and magnitude of financial distress and other events into standard valuation approaches, scenario analysis is often applied to liquidation and going concern outcomes weighted by probability.

- As a subcategory of private debt for many investors, special situations investments seeking to capitalize on event-driven mispricing have the potential to provide diversification to debt portfolios where interest income and the return of principal are primary sources of return.

SPECIAL INVESTMENT SITUATIONS

2

☐ discuss the characteristics and risks of special investment situations

Earlier Private Markets Pathway learning modules characterized private investments in company debt or equity, real estate, or infrastructure as illiquid positions held for multiyear investment periods over a range of company life-cycle or project development phases. The area of private investment that targets return by investing in stressed, distressed, or event-driven opportunities, often over a shorter time frame, is referred to as **special situations**.

In contrast to the value creation process used in other private market strategies, these opportunities involve discrete events that have a significant impact on investment value. Investment professionals often refer to **financial dislocation** as a case in which market prices are misaligned on an absolute or relative basis due to economic crises, changes in liquidity, market constraints, or other industry- or company-specific factors. While many situations may fall into this category, we distinguish here between financial distress and other event-driven opportunities.

Financial Distress

The loan or bond obligations of issuers considered unlikely to meet promised future interest and principal payments in a timely manner are referred to as **distressed debt**. Events associated with financial distress include failure to pay a contractual debt obligation on time, violation of a financial covenant in a bond indenture or loan agreement, and/or a situation in which the market value of a firm's assets falls below that of its fixed obligations when valued as a going concern. When issuers are unable to meet their fixed debt obligations, debtholders may become residual claimants to a firm's remaining net assets, as shown in Exhibit 1.

Exhibit 1: Firm Value Distribution between Shareholders and Debtholders

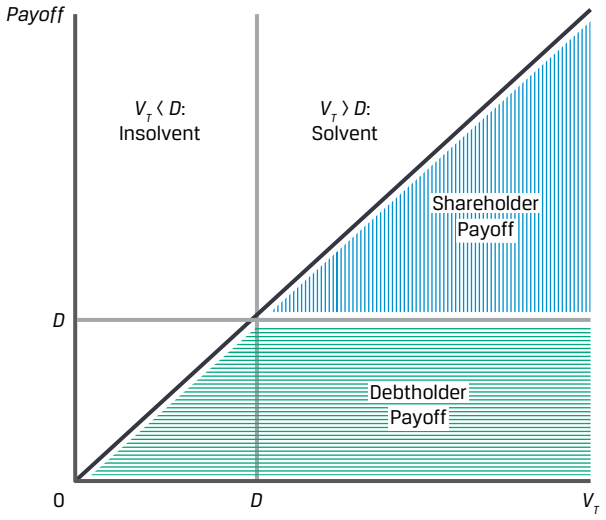


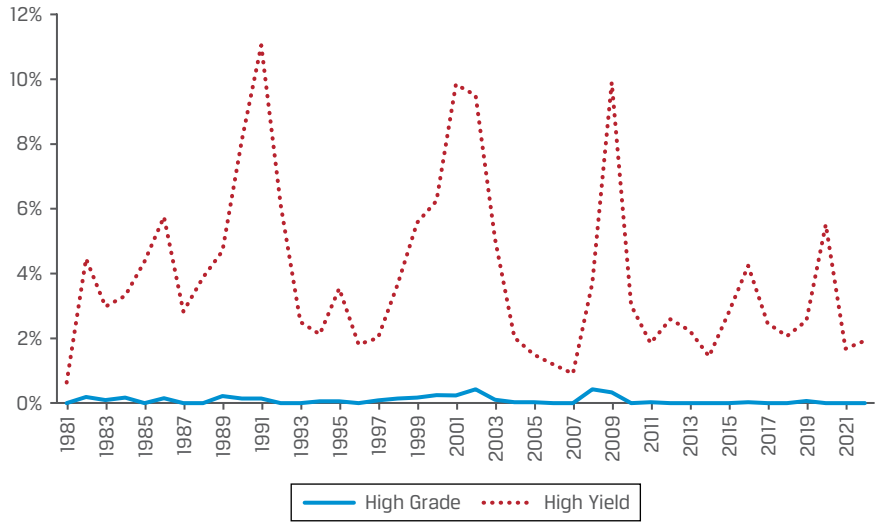
Exhibit 1 shows the example of a firm valued at time T (V_T), at which time the firm's zero-coupon debt (D) also matures. If the firm is solvent ($V_T > D$), debtholders are paid in full and shareholders capture the remaining firm value. In the case of **insolvency** ($V_T < D$), a situation in which total liabilities exceed the market value of assets, V_T is distributed to debtholders, who receive less than the promised interest and principal, while shareholders receive nothing. Earlier in the curriculum, it was shown that this relationship between shareholders and debtholders has option-like characteristics. That is, shareholders hold a long position in the firm's assets (V_T) and have purchased a put option on firm value with an exercise price of D from debtholders. The put option premium may be interpreted as the credit spread paid to debtholders.

A distressed investor might seek to capitalize on the expected outcome by either (1) purchasing the bonds of an issuer trading at a significant discount to par in anticipation of being paid in full or receiving a higher discounted price or (2) selling short the stock of an issuer that is expected to become insolvent. Beyond this short-term approach involving non-controlling trading positions, investors may seek a more active role in restructuring as a significant minority or controlling investor or use the process to acquire and eventually resell an entire company.

In practice, the assessment and allocation of firm value among investors is more complex than shown in Exhibit 1. For example, asset valuation may vary widely when considering a forced sale to a third party versus continued operations as a going concern. Firm liabilities typically involve many claims, with more complex debt profiles and staggered interest and principal payment schedules over time, as well as different levels of seniority, security, and other contingency features. The substantial time and cost associated with the **bankruptcy** process are important drivers of alternative approaches, described later in this learning module.

Causes of financial distress include economic downturns leading to poor operating and financial performance and company- or industry-specific factors adversely affecting a firm or industry. For example, Exhibit 2 shows global annual corporate default rates from S&P Global Ratings over several decades.

Exhibit 2: Annual Global Corporate Bond Default Rates (%)



Source: S&P Global Ratings.

Exhibit 2 demonstrates that the likelihood of default rises significantly amid economic slowdowns, reaching highs during the 1990–91 and 2001 recessions, the Global Financial Crisis of 2008-2009, and, to a lesser degree, the COVID-19 pandemic. Defaults are also far more frequent among high-yield issuers, or those with sub-investment-grade ratings at the time of default. One measure of investor loss in a default scenario is the **credit loss rate**, the *realized* percentage of par value lost to default for bonds, equal to the bonds' default rate multiplied by the loss severity. According to Moody's Investors Service, the highest annual credit loss rate for US investment-grade corporate bonds since 1983 was close to 0.4%, with an average of 0.05%. For high-yield bonds, the average credit loss rate was around 2.5%, while in several years, usually around economic recessions, losses exceeded 5%.

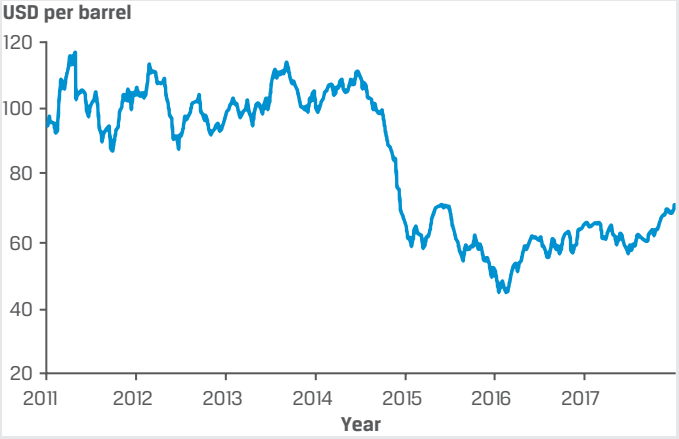
Industry-specific factors often play a role in the financial distress of firms, even in periods of relative macroeconomic stability. Earlier in the curriculum, risk factors considered that affect overall industry performance beyond cyclicality included industry structure and concentration, competitive intensity, value chain dynamics, and long-term growth and demand. For example, commodity-based companies are often considered among the most cyclical due to the direct impact of underlying economic activity and consumer demand on prices. However, the impact of supply increases and technological change may also contribute to weaker industry performance, as highlighted in the following example.

EXAMPLE 1

Petroleum Industry Bankruptcies amid the Global Oil Price Collapse

Beginning in July 2014, global oil prices faced their most sustained decline of the 21st century. The US benchmark West Texas Intermediate (WTI) crude oil price fell from highs of well over USD100 per barrel through mid-2014 to just USD30 per barrel in early 2016, as shown below.

WTI Price per Barrel (USD), 2011–2018



Source: Bloomberg.

Supply outpaced demand due in part to new discoveries in the Permian Basin in the United States, as well as drilling technology improvements using hydraulic fracturing (or fracking) that lowered breakeven prices for crude oil production. Given balance sheets that hold predominantly fixed assets financed heavily by debt, the sustained oil price decline drove oil and gas firm revenues and profits sharply lower, forcing several exploration and production companies to seek bankruptcy protection in 2015. By late 2016, over 200 petroleum industry companies had filed for bankruptcy.

Weak demand for oil production and refinery equipment also caused recovery rates to plunge. Prior to 2015, historical recovery rates in the oil and gas industry averaged 58%. For the industry bankruptcies in 2015, recovery rates averaged only 21% as the value of oil production assets declined due to these industry-specific circumstances.

In other instances, financial distress is isolated to a single company. Company-specific risk factors include a single firm's weak or deteriorating competitive position in an industry, product market risk, execution risk, and excessive operating leverage. A sharp deterioration in company performance in periods of economic growth and otherwise strong industry performance may result from specific adverse events, such as product recalls, litigation, isolated operating or supply chain disruptions, or management irregularities, including fraud.

EXAMPLE 2

Luckin Coffee's Accounting Fraud

Luckin Coffee Inc. was founded in Beijing in 2017 with a goal of surpassing global coffee retailer, Starbucks, by offering lower-priced coffee for takeout and delivery through its proprietary technology application. Within one year, the company experienced rapid growth and reached a valuation of USD1 billion, with venture capital (VC) funding from one of China's largest VC funds, as well as from Singapore's sovereign wealth fund, GIC. Luckin Coffee continued to raise new capital, including nearly USD700 million via a public offering on the US NASDAQ exchange in May 2019. By July 2019, the company was valued at USD4 billion, with 5,000 locations across China and plans to double the number of stores by the end of 2021.

The company's impressive growth reports prompted skepticism from some in the investment community. At the end of January 2020, a short seller released a research report based on customer traffic at Luckin Coffee locations compared to sales figures reported by the company. The research report suggested that Luckin had overstated 2019 revenues by as much as 88%. Luckin's auditor, EY, later found evidence of revenue overstatement in early 2020. China's market regulator initiated an investigation, concluding that Luckin had inflated revenues and misled investors.

Luckin shares were subsequently delisted from NASDAQ, and the US Securities and Exchange Commission imposed a USD180 million penalty on the company. In February 2021, Luckin Coffee filed for Chapter 15 reorganization in US bankruptcy court with plans to continue operations. When it emerged from bankruptcy, Luckin was able to find new investors and restart its revenue growth trajectory.

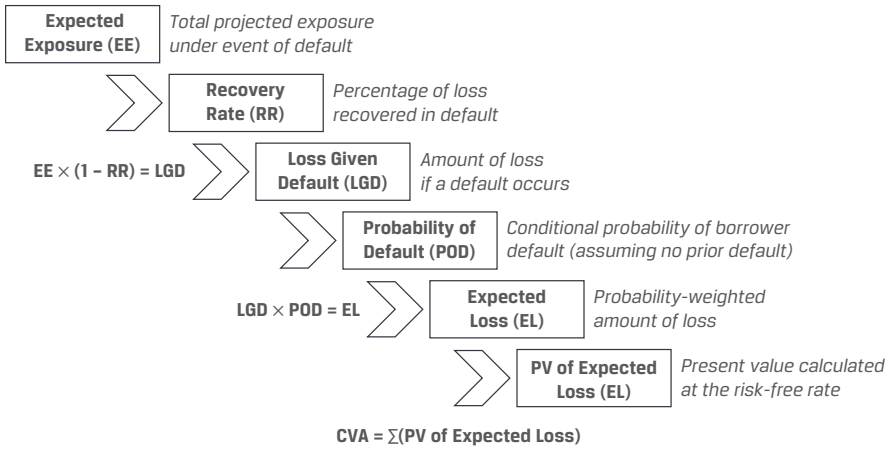
Special situations investors may take positions in the outstanding loans, bonds, or equity of distressed issuers to capitalize on expected price appreciation, as described above. More complex approaches may involve hybrid securities, such as convertible bonds, or combine short and long positions in instruments with different claims in the issuer's capital structure, as described later. Other strategies include the purchase of assets from forced sellers in liquidation at a discount to fair market value or the provision of special forms of secured financing to firms in distress.

Beyond the macroeconomic, industry, and company risks highlighted previously for corporations, distressed situations involve several additional risks unique to these investments, as described next.

Credit Risk

The **credit valuation adjustment (CVA)** framework introduced earlier in the curriculum is shown in Exhibit 3.

Exhibit 3: Credit Valuation Adjustment



Recall that CVA measures the present value of expected loss (EL), or the product of the probability of default (POD) and loss given default (LGD).

$$EL = LGD \times POD. \quad (1)$$

Since distressed debt often involves issuers whose default may be imminent, as POD approaches 100%, expected loss rises to nearly equal the loss given default, with the underlying debt price (as a percentage of face value) approaching the expected recovery rate in a default scenario.

To properly diagnose sources of credit risk, analysts and investors typically distinguish between short-term issuer liquidity and longer-term solvency issues. Liquidity refers to the relative ability to convert a firm's resources into cash over an asset conversion cycle to cover its immediate obligations, while solvency assesses an issuer's cash flow generation potential over multiple periods to meet interest and principal payments.

Investor Liquidity Risk

Debt and equity instruments of issuers facing financial distress often face limited liquidity as price volatility rises. Many market participants are forced to sell if their investment policies preclude ownership of distressed debt or equity securities. Public equities failing to meet minimum exchange price requirements are often delisted as a firm approaches default.

Operational Risk

Firms facing financial distress may lose employees, customers, or suppliers unwilling to bear the greater risk of non-payment or liquidation while a firm restructures its debt or pursues bankruptcy.

Legal Risk

The costs and uncertainty associated with financial distress include creditor disputes and bankruptcy proceedings. As both the risks and costs associated with bankruptcy and other forms of litigation reduce the assets available to settle claims, distressed debt investors must weigh these costs against the potential benefits of pursuing such legal action.

Financial distress affects both corporate and sovereign issuers. A sovereign borrower's creditworthiness may deteriorate due to excessive fiscal deficits, inflexible monetary and exchange rate policies, or adverse economic conditions.

Sovereign borrowers in highly developed markets generally reflect the lowest credit risk among public sector borrowers. These issuers have the power to tax economic activity in highly diversified economies engaged in global trade with freely floating currencies widely held by external parties, including central banks, referred to as **reserve currencies**.

Sovereign issuers in *developing* markets, in contrast, are more susceptible to financial distress, for several reasons. These less wealthy economies often have limited economic diversification, fewer foreign trade partners, and less developed domestic financial markets. In addition, the restrictive, non-convertible, and often fixed exchange rate regimes in these economies limit policy effectiveness, magnify the impact of economic shocks, and increase the likelihood of financial distress. These countries with non-reserve currency regimes often rely on foreign direct investment and issuing debt denominated in major foreign currencies, which require sufficient currency reserves to service interest and principal and to pay for essential imports.

While distressed corporate issuers often enter legal bankruptcy proceedings to continue operations while restructuring debt, the principle of **sovereign immunity** limits the legal recourse of lenders to enforce debt claims against distressed sovereign borrowers. As a result, sovereign financial distress typically results in the restructuring of outstanding debt rather than asset sales or liquidation. On one hand, fiscal deficits and declining tax revenues are common sources of distress among sovereign bonds denominated in domestic currency. Foreign currency bonds, on the other hand, are more susceptible to weaker external conditions, which may involve domestic currency

depreciation due to lack of competitiveness and/or falling foreign currency reserves. The unique example of El Salvador demonstrates the impact of a mismatch between a country's reserves and its outstanding debt.

EXAMPLE 3

El Salvador Averts External Debt Default

As a lower-middle-income developing country in Central America seeking to promote stable inflation and growth, El Salvador adopted the US dollar as its official currency over two decades ago following a period of pegging its currency to the US dollar. Despite a strong economic rebound following the COVID-19 shutdown, fiscal deficits remained high, and the country was heavily dependent on short-term external debt, with a debt-to-GDP ratio of over 80%.

In 2021, El Salvador's president, Nayib Bukele, made the country the first to adopt bitcoin (XBT) as legal tender, claiming it would ease the transfer of remittances from abroad and make digital transactions more accessible to an underbanked population. The country began actively purchasing the crypto-currency as part of its external reserves. However, the USD/XBT exchange rate suffered a decline from over USD60,000 per XBT to approximately USD20,000 by July 2022, which coincided with a plunge in the price of El Salvador's 5.875% US dollar–denominated sovereign bonds to just 30% of par, as shown in Exhibit 4.

Exhibit 4: USD/XBT vs. 5.875% 2025 El Salvador US Dollar Bond

Source: Bloomberg.

Sharp declines in XBT in the wake of pending near-term US dollar debt maturities cast doubt on El Salvador's ability to meet its external obligations, leading to ratings downgrades from S&P and Moody's to CCC+ and Caa3, respectively.

The price of El Salvador's external bonds rebounded in the latter half of 2022 as the government offered to buy back a portion of its outstanding debt using reserves and was also able to arrange a USD450 million loan from the Central American Bank for Economic Integration, a multilateral financial institution focused on regional economic development. With this partial debt repurchase, incremental new funding and a mild XBT rebound, El Salvador averted default on the January 2023 bond maturity as debtholders were repaid in full.

While sovereign immunity precludes such issuers from entering bankruptcy proceedings, investors in distressed sovereign debt face losses under a default scenario that often involves a debt restructuring plan in conjunction with a multilateral financial institution, such as the International Monetary Fund (IMF). While such plans are often accompanied by austerity measures, such as budget cuts and tax increases, debt investors incur losses in the form of interest and principal payment grace periods, extended payment terms, and other borrower concessions.

Reputational Risk

Investors in corporate or sovereign distressed debt face the potential of displacing workers, disrupting communities, and having an adverse environmental impact when forcing a firm to liquidate its assets or pursuing legal claims. Many public sector investors, such as pension funds and sovereign wealth funds, are wary of failing to meet their environmental, social, and governance (ESG) objectives when investing in such opportunities. For example, investors in sovereign debt obligations of **heavily indebted poor countries (HIPCs)**, a specific group of developing countries eligible for support from the IMF and the World Bank due to high rates of poverty and significant indebtedness, may be seen as taking advantage of such crises, as described in the following example.

HIPCS AND DISTRESSED DEBT FUNDS

The IMF and the World Bank launched the HIPC Initiative in 1996 to help HIPCs avoid unsustainable debt burdens.

Sovereign debt crises have posed a challenge to this goal when special situations funds use a strategy to purchase a portion of a country's distressed external sovereign debt in the secondary market at a deep discount. In some cases, a fund may elect not to participate in the restructuring process and use litigation to either attempt to recover the debt's face value or settle at a significant premium to the price originally paid. The offshore legal expenses and considerable time over which such litigation occurs impose a high burden on HIPCs. According to the African Development Bank Group, such fund efforts to target HIPC distressed debt are often successful, leading to annualized returns on investments ranging from 50% to 333%, among the highest for distressed debt investing.

Strategies to help HIPCs and other developing countries avoid financial distress and heavy indebtedness have been combined with environmental conservation initiatives. For example, in 2022, Belize and a subsidiary of The Nature Conservancy (TNC) agreed to a debt-for-nature swap under which the country was able to repurchase its external debt in exchange for fixed annual marine conservation expenditures during the 19-year loan term. Gabon entered a similar USD500 million debt-for-nature swap in the next year, repurchasing outstanding debt at a discount in exchange for an extended term loan at a lower interest rate contingent on promising to fund conservation efforts.

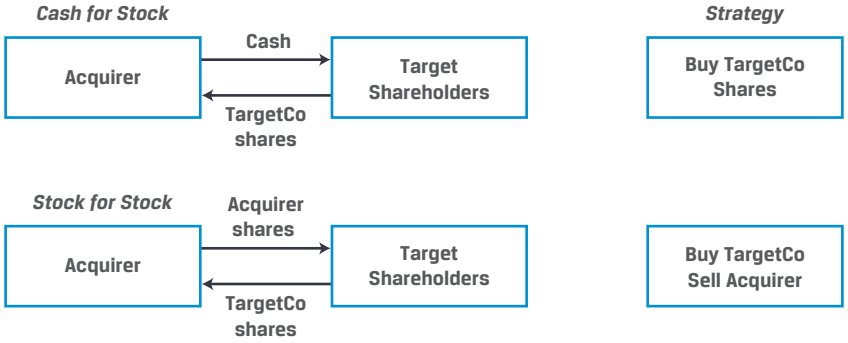
Corporate Actions and Other Event-Driven Opportunities

Special situations other than financial distress that drive investment opportunities include corporate actions such as business combinations, sales, and tender offers. In other cases, investors seek to capitalize on expected investment value due to litigation, regulatory sanctions, or significant issues adversely affecting an issuer's competitors, key suppliers, or customers.

Other than financial distress, mergers, acquisitions, and divestitures are the most common event-driven situations that drive significant valuation changes. Special situations associated with business combinations are often referred to as **merger arbitrage** opportunities, which involve investors seeking to capitalize on price discrepancies of one or more securities issued either by the target, the acquirer, or another party associated with a transaction. Unlike the risk-free arbitrage associated with the law of one price introduced earlier in the curriculum, this form of mispricing is related to informational inefficiencies associated with the likelihood, timing, and final terms at which a transaction occurs that may cause securities to trade at a different value. Merger arbitrage managers commonly use borrowed funds to generate leveraged returns. The use of borrowed funds depends on the expected payout and the degree of confidence in the merger successfully closing.

Merger arbitrage opportunities are typically triggered by the announcement of a potential transaction for which the target company (TargetCo) is often acquired using cash or stock, as shown in Exhibit 5.

Exhibit 5: Merger Purchase Method and Corresponding Arbitrage Positioning



Whether a merger or acquisition is announced as an all-cash or all-stock deal, the market price of TargetCo typically remains below the announced price given the uncertainty associated with closing the transaction. The **arbitrage spread**, or the difference between the announced acquisition price and the post-announcement market price, represents the potential return opportunity of a merger arbitrage strategy if the deal closes based on original terms ignoring transaction costs. The simplest form of arbitrage is an all-cash transaction that involves the purchase of TargetCo shares in anticipation of deal closure, while an all-stock deal arbitrage strategy often combines a *purchase* of TargetCo shares and a *short sale* of the acquirer's shares, as shown in the following example.

KNOWLEDGE CHECK

Windslater Corporation seeks to acquire all the shares of Spruceneedle Company. Windslater's management team is considering two possible acquisition strategies: an all-cash purchase and an exchange of shares. Spruceneedle's share price prior to the acquisition announcement is CAD40 per share, and Windslater plans to offer a 25% premium. Windslater's current share price is CAD100 per share.

1. Calculate the arbitrage spread if Windslater announces an all-cash purchase of Spruceneedle's shares and the share price increases to CAD46 upon this announcement. Discuss one fundamental reason why the arbitrage spread is greater than zero.

   Solution:

   Given the 25% premium, Windslater is offering CAD50 per share for Spruceneedle [= 40 × (1+0.25)], so the arbitrage spread equals CAD4 per share (= 50 – 46). An investor engaging in merger arbitrage would buy Spruceneedle shares at CAD46 upon the acquisition announcement with a possible payoff of CAD50 when the acquisition is completed. The arbitrage spread is greater than zero because there is a significant probability that the acquisition will not be completed as of the acquisition announcement date.

2. Discuss the trade that a merger arbitrage investor would likely construct if Windslater announces a stock-for-stock transaction if Spruceneedle's share price increases to CAD46 upon announcement and Windslater's share price is unchanged.

   Solution:

   The merger arbitrage investor would buy shares of Spruceneedle and sell shares of Windslater. Given Windslater's CAD100 price per share and the CAD50 purchase price for Spruceneedle, Windslater would offer to pay 0.5 share for each Spruceneedle share. The merger arbitrage investor would construct a similar trade by selling 0.5 share of Windslater for CAD50 and buying one share of Spruceneedle for CAD46. This trade results in a CAD4 per share arbitrage spread if the acquisition closes as announced.

Acquirers with liquid shares that may attract short selling under such strategies frequently seek to minimize stock price declines following a merger announcement by offering to purchase a company with a combination of cash and stock. Regardless of whether a merger is announced using all cash, all stock, or a combination of the two, the main risk associated with merger arbitrage is the same—namely, that the announced transaction does not take place. While most mergers are ultimately consummated, many fail for various reasons, which include the following:

- Debt financing becomes unavailable or subject to far less attractive terms.
- Governments, antitrust and competition regulators, or foreign investment rules in a region or country prevent the merger's completion.
- Changes in economic or industry conditions make the merger less attractive.
- Merger due diligence uncovers cases of fraud or material misrepresentation.
- A third-party bidder makes a counteroffer, which may delay timing but still results in a higher purchase price.

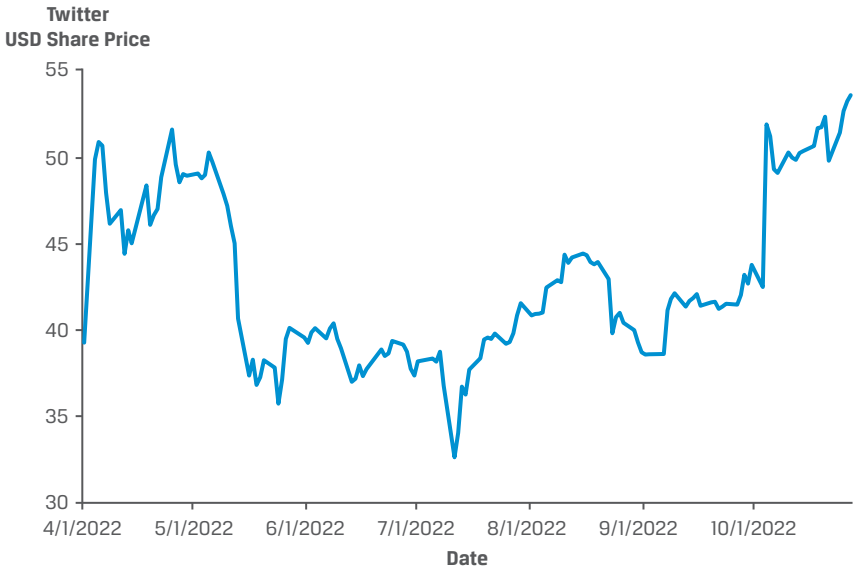
CASE STUDY

Elon Musk's Twitter (X) Acquisition

In April 2022, billionaire investor Elon Musk announced plans to acquire the social media company Twitter in a USD44 billion transaction that valued the firm at USD54.20 per share. The price represented a 38% premium over Twitter's traded price on the day before the announcement. Initially, the proposed deal was considered hostile, but within two weeks, Musk had arranged financing and Twitter agreed to the terms in what became one of the most quickly arranged

deals of its size. Twitter's share price ranged between USD45 and USD52 during the remainder of April as investors weighed the likelihood of deal completion. Exhibit 6 shows Twitter's share price from the beginning of April 2022 until the company was taken private.

Exhibit 6: Twitter Stock Price, April–October 2022



Source: Bloomberg.

Despite its initial rapid pace, investor doubts were raised in May about the merger closing when Musk posted a comment, using Twitter, that he was reconsidering his bid pending more information regarding the proportion of "fake accounts" being reported among Twitter's total users. Twitter's share price fell to below USD40 following Musk's comments, approximately where it had traded before the acquisition announcement.

In July 2022, Musk announced plans to end his bid for Twitter as the company provided misleading information regarding the number of fake accounts on the social media platform. The initial response to this news was a decline in Twitter's price to approximately USD33 per share, before rebounding back to around USD40 by later in July. In early October 2022, Musk reversed his decision to contest the original merger agreement, and the deal closed near the end of the month at the original purchase price.

Note that an acquirer assumes all the assets and liabilities of the target company once a merger is complete, including the target company's debt obligations. As a result, business combinations also give rise to several types of debt-related merger arbitrage opportunities.

For example, recall from earlier learning modules that a **change of control** clause typically requires the issuer to offer to repurchase outstanding bonds at a fixed price at or above par if a new owner acquires a certain percentage of voting shares. In a merger scenario, this allows lenders and bondholders to put or sell back bonds to an issuer at a gain or negotiate more favorable debt terms.

In the case of debt whose repayment may not be triggered by a change of control clause, an acquirer may initiate a **bond tender offer** to buy back outstanding debt at a premium to the current market price. This public solicitation of debt to be purchased at a predetermined price for a specified period may involve either an offer of cash or an exchange of outstanding bonds for newly issued securities of equivalent value.

More complex investments combining long or short debt, equity, and/or credit default swap positions to exploit significant mispricing in a single issuer's obligations are referred to as **capital structure arbitrage** strategies. Hybrid securities such as convertible bonds offer an additional opportunity to capitalize on the perceived mispricing of underlying risk components, including interest rate risk, credit, volatility, and equity risk, in what is known as **convertible arbitrage**. As in the case of merger arbitrage, these strategies also often use borrowed funds to increase returns using leverage. Recall from earlier learning modules that convertible bonds are fixed-income instruments that enable investors to exchange debt for equity at a pre-agreed price over a specific period.

QUESTION SET

1. Discuss one fundamental contrast between special situations investing compared to investing in other private market asset classes.

   Solution:

   The most fundamental contrast between special situations and other private markets relates to the time frame of the investment horizon. While most private market investing involves value creation over a long holding period, possibly 5–10 years or longer, the value creation from special situations investing is driven by the outcome of discrete events, typically occurring over much shorter time horizons.

2. Discuss the basic return-to-risk trade-off being considered by an investor in a cash-for-stock merger arbitrage opportunity in which an acquiror bids EUR70 for a target company and the target's stock price rises from EUR54 to EUR66 upon the acquisition announcement. Assume that the target stock falls to its original price if the merger does not close.

   Solution:

   The investor is considering whether a 6.06% (= 4 ÷ 66) return is a sufficient return for taking the risk that the acquisition will be successfully completed relative to the possibility of –18.18% (= –12 ÷ 66) return if the acquisition attempt fails and the target's stock price falls to its prior price.

3. Which one of the following best states the credit risk faced by an investor in the distressed debt of an issuer whose default is imminent?

   A. Probability of default (POD) by the issuer

   B. Loss given default (LGD) of the issuer

   C. Both POD and LGD

   Solution:

   B is the correct response. Because the distressed debt issuer's default is imminent, POD approaches 100%. Therefore, expected loss is equal to LGD, with the underlying debt price (as a percentage of face value) approaching the expected recovery rate in a default scenario. The investor is taking a view on how the realized recovery rate compares to the expected recovery rate priced into the security at the time of investment. A is not correct, because the POD is approximately 100% for the issuer of a distressed debt security whose default is imminent. C is not correct, because this response incorrectly includes POD.

DISTRESSED DEBT

3

☐ discuss the features of distressed debt, financing alternatives for issuers in financial distress, and investment strategies in distressed situations

As described earlier, distressed debt involves the fixed obligations of issuers that are insolvent, face the risk of insolvency, or have a higher likelihood of failing to meet interest or principal payments in a timely manner. While both sovereign and corporate borrowers experience financial distress, our focus here is on corporate distressed issuers.

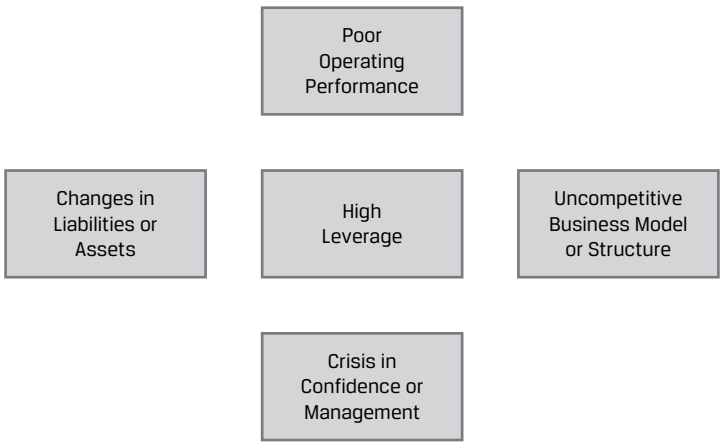
Distressed Debt Features

No universally accepted definition of distressed debt exists, although practitioners often identify such issuers by the observed market price of outstanding debt or equity obligations. That is, issuers with a bond yield *spread* of over 1,000 bps above the risk-free rate for a similar maturity or a corresponding loan *price* below 90% of par are usually classified as distressed. Alternatively, an equity price near or below the minimum trading price required to meet listing rules (such as USD1 on the New York Stock Exchange) indicates a high likelihood of distress, often leading to balance sheet restructuring, bankruptcy, or liquidation of assets.

Companies facing financial distress vary widely by size, industry, jurisdiction, and financial circumstances. Specific events associated with distress include a **technical default**, or violation of the terms and conditions of a credit or loan agreement. These events include the breach of a financial covenant or an actual non-payment of interest and principal in a timely manner, which often includes a 30-day grace period.

A thorough understanding of the causes of financial distress are an important first step in assessing a likely path for resolution and strategies for distressed investors. Exhibit 7 outlines common drivers of financial distress, which often occur concurrently.

Exhibit 7: Common Causes of Corporate Financial Distress



High Leverage

High leverage itself is often a necessary but not a sufficient condition to cause financial distress. However, the compound effects of high financial leverage and uneven operating performance over the economic cycle are a common source of financial stress among firms in cyclical industries. The expected duration and severity of these effects are important factors when considering debt restructuring alternatives and investment prospects. While minor debt adjustments may be sufficient to address liquidity constraints, solvency issues may warrant more significant capital structure changes.

For example, a retailer with strong market share and operating performance may become unable to meet current debt service obligations amid declining cash on hand, rising inventories from slower sales, and delays in accounts receivable collections. A lender might conclude that given the firm's otherwise strong performance, sales and margins will rebound quickly, opting to amend the terms of the company's short-term debt obligations to bridge the temporary shortfall in net cash flow generation. In other cases, a cyclical downturn may prompt an issuer to reduce leverage via asset sales, as in the following example.

EXAMPLE 4

Swedish Real Estate Firm SBB Sells Assets to Reduce Leverage

Samhällsbyggnadsbolaget i Norden (SBB), a Swedish property company known as the country's largest landlord, was long known as a favorite of individual investors because of its growth, financial stability, and strong history of dividends. In 2021, SBB announced plans to nearly triple the size of its property portfolio over the next five years, increasing its leverage substantially just as Sweden's housing market began showing a significant decline in value.

In early 2023, SBB was facing cash flow strains from interest payments and looming repayments of maturing debt. The firm lost its investment-grade ratings and was downgraded several times during the year, reaching a speculative CCC+ S&P rating. To address short-term cash flow pressures, SBB embarked on a strategy of selling properties at a discount to book value. By late summer of 2023, market prices of SBB's securities declined to levels suggesting that SBB was unlikely to remain solvent, with senior bonds maturing within a year trading at a 15% discount to par and subordinated hybrid notes trading at a 90% discount. However, SBB's prospects improved as it accelerated its strategy of asset disposals, including a USD720 million sale to a North American real estate investor, which provided a short-term boost to its bond prices.

Changes in Assets or Liabilities

Material adverse changes in the value of key balance sheet items are an additional catalyst for financial distress. Unforeseen non-debt liabilities triggering insolvency often result from litigation, product recalls, or other forms of product- or customer-related liability that exceed a company's liability insurance coverage.

Asset impairment, in contrast, involves an adverse change in the market value of an asset in which the value falls below that which is recorded on the firm's balance sheet. Examples include changes in current assets, such as uncollectible accounts receivable, and changes in the value of long-term tangible and intangible assets.

For example, the average market value of commercial aircraft plunged by a third in the wake of the COVID-19 pandemic amid widespread travel restrictions. While newer models still in production fell the least in price, airlines and aircraft lessors accelerated the retirement of older models approaching the end of their useful life.

Poor Operating Performance

While financial distress is often cyclical, in some cases underperformance reflects overall industry decline, poor management practices, or an uncompetitive business model. Insolvency due to high debt levels combined with poor operating performance may warrant more proactive measures to downsize or restructure a business.

Uncompetitive Business Model or Structure

In other cases, a company's new business model or strategy following a restructuring may be unable to support its balance sheet debt load. A new capital structure may depend on reaching financial milestones that prove to be unattainable. In the following example, this situation occurred in two phases.

EXAMPLE 5

Galeria Karstadt Kaufhof (GKK) Insolvency Proceedings

In 2023, Germany's largest department store chain entered insolvency proceedings, the German equivalent of US bankruptcy, for the second time in less than three years due to challenging market conditions and poor operating performance. Formed by a merger of Germany's two largest retailers (Karstadt and Kaufhof) in 2019, GKK's owners were slow to consolidate the combined firms' operations and realize the value of real estate holdings among its nearly 200 locations, facing resistance from its 34,000 unionized employees.

The firm first declared insolvency in July 2020 in the wake of the COVID-19 pandemic, emerging three months later with over EUR2 billion in debt write-downs, over 40 store closures, and several thousand employee layoffs. GKK was placed under new management with the goal of achieving growth in part by expanding its online sales from just over 4% of total revenue.

However, these measures did not prove sufficient to turn the company around, as it once again declared insolvency in March 2023. A second restructuring plan called for the closure of 50 additional stores, the downsizing of remaining locations in central business districts, and the release of an additional 4,000 employees from a level just half that at the time of the announced merger. Lenders were forced to accept a further EUR1 billion in debt losses.

Crisis in Confidence or Management

The discovery of fraud, aggressive accounting practices, or other financial irregularities often results in financial distress or bankruptcy. For example, the accounting fraud involving the falsification of Luckin Coffee sales data described earlier led to a delisting of the stock and a US bankruptcy filing in addition to investor lawsuits, from which the company successfully reemerged under new management.

Proper diagnosis of the causes and severity of declining creditworthiness is an important first step in determining appropriate steps to stabilize and improve performance. We return to the case study introduced in an earlier learning module to evaluate potential remedies to mitigate financial distress and identify associated investment strategies.

CASE STUDY

Maudville Corporation Take-Private Transaction

Maudville Corporation, a US chemical producer with USD5 billion in revenue and EBITDA of USD1 billion, was taken private for USD5 billion by the buyout equity firm Bardstown Partners; 20% of the purchase price was funded with private common equity, 5% in private convertible preferred shares, and 75% in private debt. These funds were used to buy and retire the USD5 billion of publicly held equity. Bardstown plans to restructure and sell the company, targeting a 35% internal rate of return (IRR) on its equity investment over five years.

Under new leadership, Maudville worked with Bardstown and both syndicated bank and private lenders to create the following debt profile.

Maudville Corporation Original Take-Private Debt Profile

Debt Tranche	Size	Pricing	Tenor	Terms and Conditions	Lender(s)
Secured Revolving Credit Facility	USD250 million	MRR + 150 bps p.a. on drawn amounts	364 days	Secured by first lien on Maudville's fixed assets	Syndicated bank group
Senior Secured Leveraged Loan	USD2.65 billion	MRR + 200 bps	Seven years; Prepayable at par starting in one year	Secured by first lien on Maudville's fixed assets; Ranks *pari passu* with other senior secured debt; 6× debt-to-EBITDA maintenance covenant	Syndicated bank group
Junior Second Lien Fixed-Rate Tranche	USD600 million	8.00% fixed	Seven years; Amortizing in four equal installments starting Year 4	Secured by second lien on Maudville's fixed assets; Ranks *pari passu* with other junior secured debt; 6× debt-to-EBITDA maintenance covenant	100% Bardstown Credit Partners
Mezzanine Debt Tranche	USD500 million	12.2% fixed	10 years	Unsecured subordinated obligation; Ranks *pari passu* with all other subordinated indebtedness; 6.5× debt-to-EBITDA maintenance covenant	50%: Bardstown Mezzanine Opportunity Fund; 50%: Another private debt GP. Bardstown retains majority voting rights to amend mezzanine debt terms

Maudville's five-year restructuring plan seeks to achieve 5% in annual sales growth while reducing cost of goods sold (COGS) as a percentage of sales by 1 percentage point per year from 55% in Year 0, with annual 1 point SGA reductions as a percentage of sales from 25% starting in Year 3. Since the leveraged loan is prepayable at par after a year, early debt amortization involves the senior secured leveraged loan.

1. Calculate Maudville's term debt maturity schedule, and evaluate possible events leading to financial distress over the five-year restructuring period.

Solution:

Maudville's term debt maturity schedule is as follows:

Year/Amortization (USD thousands)	Senior Secured	Junior Second Lien	Mezzanine	Total
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	150,000	0	150,000
5	0	150,000	0	150,000
6	0	150,000	0	150,000
7	2,650,000	150,000	0	2,800,000
8			0	0
9			0	0
10			500,000	500,000

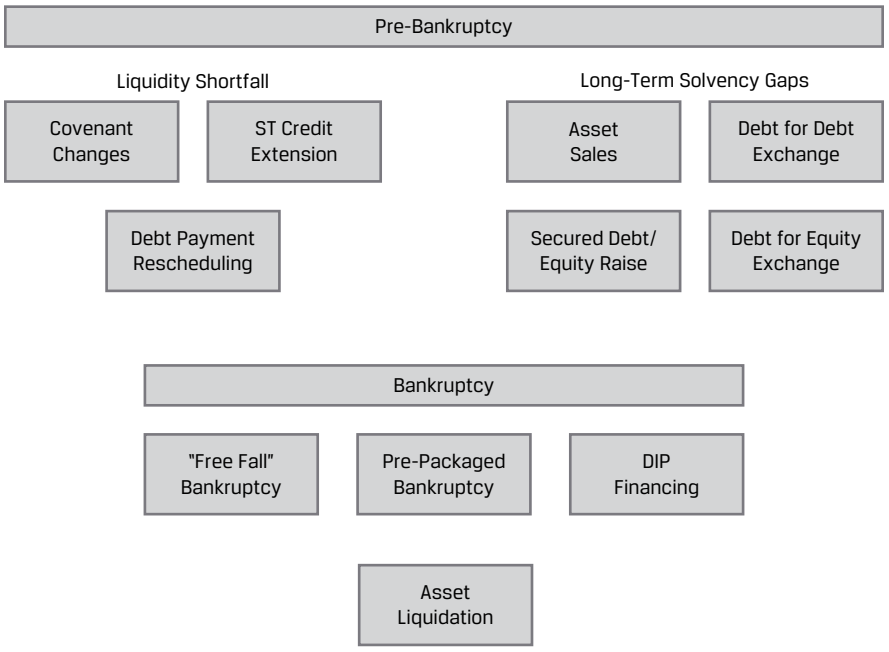
While *voluntary* senior secured debt paydowns may occur earlier, note that no *mandatory* debt amortization is scheduled until Year 4.

Key potential events associated with financial distress over the five-year period include Maudville's failure to make timely interest payments, which may fluctuate in the case of the senior secured loan as the market reference rate (MRR) changes, and principal payments, which apply to the junior second-lien loan in Years 4 and 5. Also, Maudville must maintain at least a 6× debt-to-EBITDA ratio to avoid a technical default on its senior secured and junior second-lien loans and a 6.5× debt-to-EBITDA ratio to avoid a covenant breach on its mezzanine debt.

Distressed Debt Financing Strategies and the Bankruptcy Process

Credit risk, as defined earlier in the curriculum, refers to changes in the likelihood of default and loss severity under a default as reflected in market credit spreads. In contrast, actual technical or legal defaults must be addressed to avoid a contract violation triggering demand for full debt repayment. Issuers and investors have several alternatives and financing strategies to mitigate financial distress, as shown in Exhibit 8.

Exhibit 8: Financing Strategies for Firms in Financial Distress



The use of alternatives outlined in Exhibit 8 varies widely based on different circumstances, including whether the issuer faces a short-term liquidity or long-term capital gap, as well as the possibility of a negotiated outcome with creditors without entering bankruptcy.

If the source of financial distress is limited to a temporary lack of short-term assets to meet obligations over an operating cycle, a solution is most often negotiated with liquidity providers. This may involve increasing the size of revolving credit agreements or working capital facilities, extending tenors, or waiving or changing covenants. For example, an issuer could agree to step up coupons or credit spreads if covenant levels are breached or seek less restrictive thresholds in exchange for higher pricing or other borrower restrictions or concessions.

Addressing long-term solvency gaps typically also requires a distressed issuer to negotiate additional sources of financing or reduce financial leverage. Common alternatives shown in the upper right of Exhibit 8 are as follows:

- *Sale or pledge of assets.* Given the general lack of cash among distressed firms, asset sales are a frequently used means of debt reduction. Whether considering the disposition of specific fixed assets or non-core businesses, pre-bankruptcy negotiation of sales provides sellers a greater opportunity to negotiate with strategic buyers and avoid forced sales at liquidation prices. Any assets used in ongoing operations previously excluded from secured debt collateral provisions may be included to improve the security position of lenders.
- *Secured debt or equity raise.* Raising additional debt or equity is another means of increasing capital, which for distressed firms is generally unavailable on an unsecured basis. Incremental borrowing may occur against assets that are not already fully encumbered under existing bond or loan agreements. Raising equity capital offers a debtor-friendly means of increasing

firm solvency, which in the interest of time is often sourced from existing shareholders, while a secondary equity offering to new investors takes more time and involves greater cost.

- *Debt purchase or exchange.* A distressed issuer with sufficient liquidity could enter open market purchases of discounted debt or make a formal tender offer to retire certain debt tranches. In practice, however, the limited liquidity available to such issuers usually leads to a debt exchange in which the issuer offers new securities for existing bonds with lower par values, longer maturities, and other measures to ease the firm's debt burden. This approach, known as a **distressed debt exchange**, is accepted by bondholders to avoid the cost and a potentially worse outcome in the case of a bankruptcy filing.

Let us revisit the case of Maudville to consider its possible alternatives in a financial distress scenario.

CASE STUDY

Maudville Faces Financial Distress

During the first two years under new management, Maudville successfully executes on its business plan to grow sales, increase EBITDA, and reduce debt amid a stable economic environment. However, in Year 3, the company experiences a sharp drop in performance, with sales falling 7% amid increasing labor and material costs, driving COGS to 60% of sales. Maudville's key financial ratios derived from its income statement, retained cash flow (RCF), or net cash from operating activities less dividends, and balance sheet for the first three years are as follows:

Maudville Corporation Key Financial Ratios

Financial Ratio	Year 1	Year 2	Year 3
EBITDA Margin	21%	22%	10%
Debt to EBITDA	3.28	2.82	6.46
RCF/Net Debt	22%	27%	11%
EBITDA/Int. Exp.	4.1	4.6	2.1

Maudville's Year 3 EBITDA is USD511 million, with USD3,302 million in remaining term debt outstanding following the paydown of USD448 million in senior secured debt. Maudville has pledged substantially all its fixed assets as collateral, except for USD75 million in railcars, trucks, and other vehicles.

1. Discuss the nature of Maudville's financial distress, as well as possible remedies to address the situation.

   Solution:

   Given its debt of USD3,302 million and EBITDA of USD511 million, Maudville's 6.46× debt-to-EBITDA ratio exceeds the 6× maintenance covenant on its senior secured and junior second-lien debt tranches, placing it in technical default.

   Technical default remedies include a one-time covenant breach waiver, requiring approval of the syndicated bank group and Bardstown Credit Partners for respective tranches; amendment of the covenant threshold to

a less restrictive level in exchange for higher pricing; or agreement to other borrower restrictions or concessions. At current EBITDA levels, Maudville's debt load exceeds the covenant threshold by USD236 million. The company could consider reducing debt by using cash to purchase debt on the open market or selling assets. One possible borrower concession might involve an incremental pledge of rail cars, trucks, and other vehicles to increase the collateral asset base.

As shown in the case study, firms with an initial covenant breach often find small open-market purchases or incremental asset sales preferable to a full debt-for-debt exchange. These and other measures can reduce debt and help avoid the bankruptcy process.

A **debt-for-equity exchange** involves the extinguishment of debt rather than amendment of debt terms in exchange for a position in the issuer's shares. Key issues to address in the case of a debt-for-equity swap include the type of equity received by debtholders (common shares, preferred shares, or convertible bonds) and the rights and restrictions associated with the new securities. Unlike the debt-for-debt exchange, existing shareholders typically face dilution when new shares are exchanged for outstanding debt.

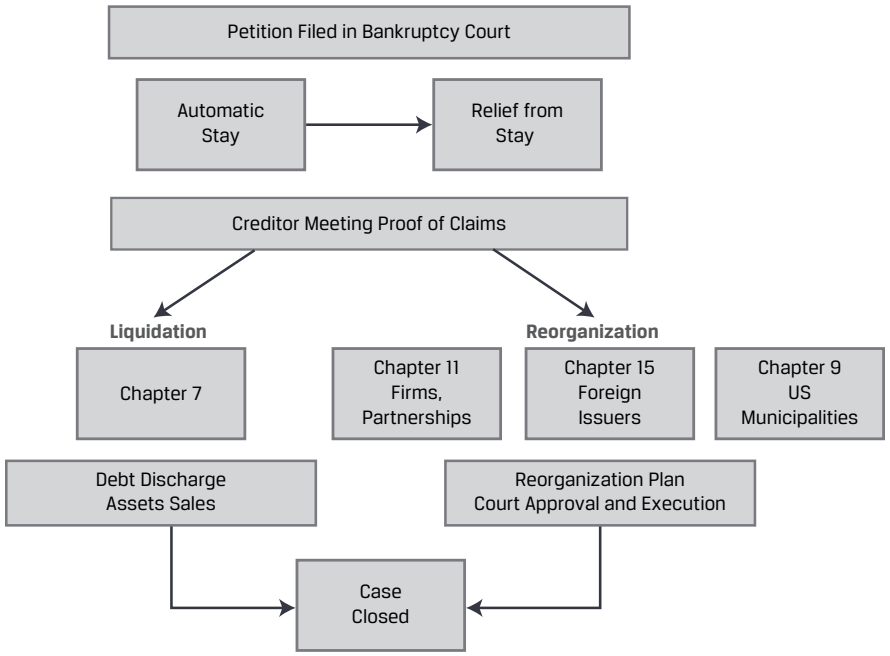
Earlier in the curriculum, it was shown that the tax benefit of greater leverage is offset by the costs of financial distress or bankruptcy. Once a firm faces distress, issuers and investors often prefer to address technical and legal defaults outside of the bankruptcy process to avoid the considerable cost and time involved. However, the ability to avert legal bankruptcy proceedings depends on several factors, including a firm's cash position, the timing and magnitude of the expected financial shortfall, the complexity of the issuer's assets and capital structure, and regulatory and other constraints.

Limited liquidity prevents firms from taking immediate steps to mitigate financial stress, such as open-market debt repurchases. When weighing other measures to reduce leverage, the time to liquidity is an important determinant of the feasibility of specific alternatives. For example, a debtor may temporarily delay trade payables or sell individual asset sales relatively quickly to raise cash, while the sale of an entire business division takes more time. The impact of a shortfall may also be magnified by a lack of time and business resources available to address the issue.

Complex business models and capital structures are more difficult to restructure with relatively short notice. For example, the inability to identify individual retail locations, fixed assets, or non-core business units for disposal can complicate the deleveraging process. Complex capital structures involving secured debt, covenant protections, layers of subordination, and intercreditor agreements restrict the flexibility of borrowers and lenders to negotiate a plan that is satisfactory to all parties. Significant regulatory or external constraints on businesses, such as labor contracts and significant pension commitments, are additional complexities that lead distressed firms to seek bankruptcy protection versus a pre-bankruptcy settlement of claims.

The bankruptcy process seeks to protect the legal rights of all parties involved, afford a distressed issuer protection from creditors when operating as a going concern is preferable, and allow for an orderly asset liquidation when it is not. The US bankruptcy process is shown in Exhibit 9.

Exhibit 9: US Bankruptcy Process



Once a debtor files for bankruptcy in a US court, it is granted an automatic stay, or protection, from lenders seeking to collect claims unless an exception (or relief) is granted. Legal protections extended to lenders in bankruptcy include strict limitations on **fraudulent conveyance**, or the transfer of assets to a third party to prevent creditors from reaching a borrower's assets. While local laws vary, US bankruptcy law allows the court to void such transactions for up to two years prior to bankruptcy filing and claw back funds to pay creditors.

FTX FRAUDULENT TRANSFERS

In November 2022, FTX, a Bahamas-based cryptocurrency exchange, filed for Chapter 11 bankruptcy protection under US law following a rapid decline in the value of its exchange token, FTT, causing a liquidity crisis. The company named a new CEO at the time of the bankruptcy filing to replace the company's founder.

Approximately eight months later, FTX Trading sued the founder of FTX as well as several other senior executives to recoup over USD1 billion in fraudulent transfers made by the company's senior executives during the two years prior to FTX's Chapter 11 filing. The complaint alleged that the defendants misappropriated funds to both offset losses of a trading affiliate and pay for luxury condominiums, political contributions, and speculative investments for personal gain.

Firms seeking to continue operations as a going concern propose a reorganization plan to be confirmed in court under a Chapter 11 bankruptcy filing. The company becomes a so-called **debtor in possession (DIP)**, remaining in control of the business under court supervision. A debtor may submit a proposal to the court to obtain **DIP financing**, a form of temporary debt financing senior to all other claims used to both cover ongoing bankruptcy costs and provide working capital and other financing to maintain operations while the firm is in bankruptcy.

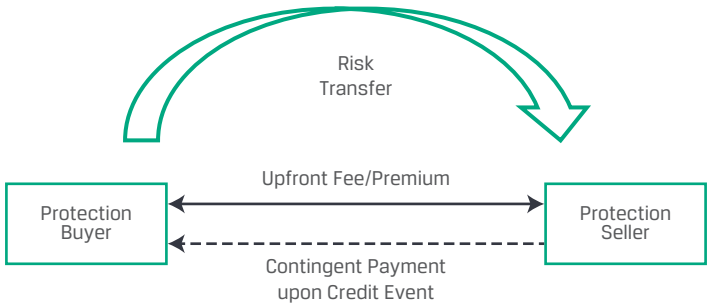
A similar reorganization process exists for US governmental entities (Chapter 9), while a Chapter 15 filing, which involves foreign creditors, is generally conducted in parallel with bankruptcy proceedings in the issuer's country of domicile.

To successfully emerge from Chapter 11, distressed firms must demonstrate that all creditors will be better off than under a liquidation scenario net of costs if asset sale proceeds were distributed according to the priority of claims. If a debtor firm cannot demonstrate greater value to lenders as a going concern, it files for liquidation under Chapter 7 of the Bankruptcy Code, turning assets over to a trustee for sale to settle all claims.

Investors who have purchased or sold credit protection on an underlying issuer facing financial distress closely track those events that may trigger a settlement of such contracts. Failure to make a debt payment, debt restructuring, or a bankruptcy filing generally constitute a **credit event** under outstanding credit default swap contracts. As shown in Exhibit 10, a protection buyer transfers the credit risk of an issuer or reference entity to a protection seller in exchange for a periodic premium. Standard CDS coupon rates of 1% and 5% exist for investment-grade and high-yield issuers, respectively. The present value difference between a periodic premium based on the issuer's CDS spread and the standard coupon for the contract life is exchanged at contract initiation.

If the defaulting issuer is a reference entity in a CDS contract, a credit event will trigger a settlement payment equal to the LGD multiplied by the contract notional amount from the protection seller to the protection buyer.

Exhibit 10: Credit Default Swap Mechanics



While US bankruptcy laws are generally considered more debtor friendly, many other jurisdictions have more stringent laws favoring creditors and are more likely to result in liquidation. In other cases, large companies considered to operate in the national economic interest may benefit from a form of direct or indirect government support such as loan guarantees or subsidies when facing financial distress to preserve domestic production and employment.

GLOBAL APPROACHES TO BANKRUPTCY

US corporate bankruptcy laws have a long history of allowing businesses to continue to operate following a bankruptcy filing, often with continuing management by the incumbent executive team. As a result, the United States has traditionally been viewed as the most debtor-friendly jurisdiction in the world. US law provides an extended period, typically 120 days, for management to file

its plan of reorganization for review by the courts and creditors. Chapter 11 reorganizations commonly take well over one year in the best of circumstances and can last several years in complicated reorganization cases.

Insolvency laws and processes vary widely among the largest developed economies. For example, the UK bankruptcy process exhibits several contrasts to the US process. Overall, UK law is considered creditor friendly, with firm control in the reorganization process (known as administration) held by an administrator rather than company management. Nevertheless, historical empirical evidence on firm survival and creditor recovery rates are similar for the United States and the United Kingdom. Other countries' laws may focus more attention on protection of employment, such as in France, and research suggests that creditor recovery rates may be lower as a result. Germany and Japan have historically had strong banking sectors, resulting in more creditor-friendly processes. However, Japan's insolvency processes have evolved to focus more on restructuring firms to continue as going concerns, similar to the US approach.

The world's two most populous countries, China and India, continue to develop and improve their systems for resolving corporate insolvency cases. China's 2007 Enterprise Bankruptcy Law represented the nation's first comprehensive bankruptcy code, and for several years, bankruptcy filings remained relatively low, although these have increased over time. Similarly, India relied on a patchwork of different laws governing bankruptcy until 2016, when the country enacted its more comprehensive Insolvency and Bankruptcy Code.

Cross-border cooperation in reorganization processes is of growing importance as firms increasingly borrow and own assets in multiple jurisdictions. In 2005, the United States added Chapter 15 to its bankruptcy code to address insolvency cases involving more than one country.

An important consideration for financing strategies outside or within the bankruptcy process is the degree of control and expected timing associated with these alternatives. Successful out-of-court restructurings may be negotiated quickly but typically require agreement of all creditors to proceed.

As for settlements that occur *within* the bankruptcy process, an approach combining the expediency of pre-bankruptcy restructuring with favorable voting rules under a Chapter 11 reorganization—namely, the required consent of two-thirds of the volume and one-half of the investors for each claimant class—is referred to as a **prepackaged bankruptcy**.

A prepackaged bankruptcy involves a detailed business plan and exit strategy formulated by the debtor and agreed on with one or more major creditors in advance of bankruptcy filing. A prepackaged plan typically accelerates the process, reduces the likelihood of liquidation, and increases an issuer's ability to attract equity capital once it emerges from bankruptcy.

If the onset of financial distress is sudden or unexpected, an issuer is more likely to enter Chapter 11 bankruptcy in a **free fall bankruptcy**, or one with no plan or pre-agreement with creditors. While a debtor still controls company assets and typically has at least 120 days to file a plan, free fall bankruptcy is usually more expensive and time consuming, with a less certain outcome.

Distressed Issuer Investment Strategies

Many creditors and investors face pressure to dispose of distressed issuer obligations, including trade creditors, banks facing regulatory capital pressures for non-performing loans, and asset managers whose investment policy statement specifies credit quality minimums. In other cases, unconstrained investors see opportunity in distressed issuer debt and equity obligations. Three broad investment strategies are shown in Exhibit 11.

Exhibit 11: Common Distressed Investment Strategies

Strategy	Trading Non-Controlling	Active Non-Controlling	Active Controlling
Target Investment	Traded debt, equity, or credit default swaps	Senior secured or unsecured public or private debt	Controlling stake in secured or unsecured public or private debt
Goal	Buy and hold	Actively engage in bankruptcy process	Seek control
Approach	Seek price appreciation or capital structure arbitrage opportunity	Seek returns upon exit from bankruptcy	Retain equity stake to continue restructuring after bankruptcy exit
Typical Holding Period	Six months or more	1–2 years	Exit in 2–3 years

The first distinction among these strategies is whether an investor takes a short-term trading position based largely on public information or seeks to actively engage in the debt restructuring process over time to influence the outcome. The former approach is commonly taken by alternative investors, such as hedge funds, as outlined in earlier in the curriculum. Specifically, credit hedge funds are well positioned to capitalize on temporary security mispricing due to the credit quality and liquidity constraints faced by many institutional investors. For example, in the case of **fallen angels**, or formerly investment-grade-rated issuers whose bonds are downgraded to high yield due to credit deterioration, a trading strategy might involve buying just after the downgrade to high yield in the wake of forced selling by high-grade investors, with a subsequent sale as these same bonds appreciate as they are widely added to institutional high-yield bond portfolios.

When evaluating distressed investment strategies in general and distressed debt in particular, it is important to look beyond standard yield-to-maturity and credit spread measures given the high likelihood of default and recovery in a default scenario, as illustrated in the following example.

EXAMPLE 6

Fallco's Distressed Bonds

A distressed credit fund manager is evaluating a possible investment in the senior unsecured bonds of Fallco, a fallen angel with one-year 6.00% and three-year 6.50% fixed senior unsecured annual coupon bonds outstanding. Both bonds recently traded at a price equal to 75% of par value. The current risk-free rate for both maturities is 5.00%.

1. Calculate the respective yields-to-maturity on Fallco's outstanding bonds and discuss the limitations associated with this return measure.

   Solution:

   Using the spreadsheet RATE function [= RATE(*nper*,*pmt*,*pv*,*fv*,*type*)], where *nper* is the number of periods, *pmt* is the periodic coupon payment, *pv* is the present value, *fv* is future or face value, and *type* corresponds to payments made at the end (0) or beginning (1) of each period, we can solve for the Fallco bond yields-to-maturity as follows:

One-year 6% coupon: 41.33% = RATE(1,6,-75,100,0).

Three-year 6.5% coupon: 18.00% = RATE(3,6.5,-75,100,0).

Investors earn a rate of return on a bond equal to its yield-to-maturity only if

- the investor holds the bond to maturity and receives payment in full,
- no issuer default occurs, and
- the investor reinvests all coupon payments at the same yield-to-maturity.

Given the distressed nature of Fallco's debt, these assumptions underlying the yield-to-maturity calculation are less likely to be met, making this an unsuitable measure of return for such bonds.

2. The credit hedge fund manager notes a 40% historical recovery rate for senior unsecured bonds in Fallco's industry sector and estimates a one-third chance of a Fallco default in one year's time. Compare the recently traded price of Fallco's one-year bond to the estimated market price using these assumptions.

Solution:

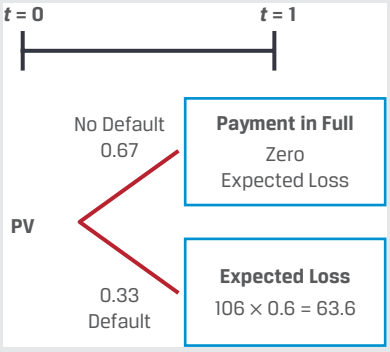
To estimate the bond's market price, we first discount the 106 cash flow to the present at the 5% risk-free rate using a simple time-value-of-money calculation:

$$PV = \frac{FV_t}{(1+r)^t}.$$

$$100.9524 = \frac{106}{(1.05)^1}.$$

The price of 100.9524 represents the present value of bond cash flows at the risk-free rate, from which we must deduct the credit valuation adjustment. Recall that the CVA is the present value of expected loss, or the probability-weighted recovery in one period, as shown below in Exhibit 12.

Exhibit 12: Expected One-Year Return on Fallco Bond



Solve for the expected loss using Equation 1:

EL = POD × LGD

= 20.99 = 0.33 × (106 × 0.6).

Solve for the present value of expected loss and subtract from 100.9524:

$$\text{PV(EL)} = 19.99 = \frac{20.99}{1.05}.$$

Estimated market price = 80.96 (= 100.9524 – 19.99). The current trading price of 75% of par value presents an attractive buying opportunity given the estimated value of approximately 81% of par value.
Alternatively, one can probability weight each of the separate outcomes:

No-default: Value = 106.

Default: Value = $106 \times 0.4 = 42.4$.

Expected end value = $0.67 \times 106 + 0.33 \times 42.4 = 71.02 + 13.99 = 85.01$.

PV(Expected end value) = 85.01/1.05 = 80.96.

This simple example illustrates key parameters used to estimate the market value of a security, but the timing and likelihood of default is highly unpredictable in the case of financial distress. More complex capital structure arbitrage investment situations involving more than one security are addressed later.

Investors actively engaged in the restructuring process via either a controlling or non-controlling stake seek to create value by influencing the outcome of a distressed debt reorganization. These investment strategies are more closely aligned with private equity investments, except for the timing and method of investment.

In contrast to a more orderly take-private transaction in which a private equity sponsor contributes equity and raises debt for the remainder of the purchase price, an active distressed investor may acquire at least half of an issuer's outstanding loans and bonds, or a third in order to establish a blocking minority stake, with the goal of acquiring the firm in a debt-for-equity swap and likely contributing additional equity or partnering with another equity investor at a later stage.

Private equity GPs often view distressed situations as an attractive entry point to combine and consolidate companies within an industry following a cyclical downturn. For example, private equity played an active role in the oil and gas industry consolidation following the wave of bankruptcies described in an earlier example. By acquiring a controlling stake during the reorganization process, private investors can negotiate sweeping management changes, cost reductions, and other concessions that may contribute to a more rapid turnaround of a company than under stable market conditions. In some cases, a highly sought-after distressed firm may be purchased at terms favorable to the company's creditors, as in the following example.

HERTZ EMERGES FROM BANKRUPTCY

Hertz, a US rental car company, began Chapter 11 bankruptcy proceedings in May 2020 following the onset of the COVID-19 pandemic and the resulting decline in all travel-related businesses. In an interesting turn of events, used car prices soared in late 2020 because of global car shortages. Hertz took advantage of this opportunity to sell approximately a third of its fleet. As travel began to resume more quickly than anticipated in early 2021, the shortage of available vehicles caused car rental rates to soar.

In this environment, Hertz attracted interest from several private equity investor groups looking to bring the company out of bankruptcy. After a bidding war in spring of 2021, the winning investors paid approximately USD5.9 billion for Hertz. As part of their bid, both secured and unsecured claims in the company's Chapter 11 case received 100% payment and existing shareholders received small allotments of cash and equity stakes in the reorganized company.

Active controlling investors usually hold their positions for two to three years following the exit from bankruptcy.

Active investors who are *not* seeking to take a controlling stake in the company may also purchase distressed debt and participate in creditor committees, as well as provide post-bankruptcy financing. These investors typically hold smaller stakes, may partner with larger or smaller investors to influence restructuring outcomes, and are more likely to exit soon after the company emerges from bankruptcy.

QUESTION SET

1. Discuss the circumstance under which excessive leverage is likely to contribute to a company's financial distress and its potential severity.

   Solution:

   While excessive leverage can be a factor leading to financial distress for a company, a compounding factor such as poor operating performance is usually necessary to create distress. The severity of distress may depend on whether poor operating performance is of a short-term cyclical nature or is evident of longer-term performance issues. High leverage increases the amount of cash flow necessary to service a company's debt.

2. Which of the following is the most likely strategy for a company whose debt-to-EBITDA ratio rises above a level defined in maintenance covenants?

   A. Raise additional debt capital.

   B. Reschedule debt repayment.

   C. Sell operating assets to raise capital.

   Solution:

   B is the correct response. The violation of a maintenance covenant reflects a technical default, and the most likely response is a short-term liquidity strategy, such as rescheduling debt repayments. A and C are incorrect because both represent strategies that would be used if the default were characterized by a longer-term insolvency issue.

3. Contrast the seniority ranking of debtor-in-possession financing of a company filing Chapter 11 bankruptcy relative to that of its existing debt claims, and explain a rationale for the relative ranking of DIP financing.

   Solution:

   DIP financing is short-term debt senior to all other existing claims against the debtor. This temporary financing is used to both cover ongoing bankruptcy costs and provide working capital and other financing to maintain operations while the firm is in bankruptcy. Thus, lenders need senior status to be willing to provide this capital to the bankrupt company.

4. Evaluate the following investment opportunity available to a distressed debt investor: Failco has a one-year 8% coupon bond trading at 70% of par value. The investor estimates a 60% chance of default for Failco and a 55% expected recovery rate. The current risk-free rate is 4%.

   Solution:

   Expected loss if Failco defaults:

EL = 0.60 × (0.45 × 108) = 29.16.

Expected payoff in one year to buying Failco bond:

Expected payoff = 108 – 29.16 = 78.84.

Fair market value for Failco bond:

Value = 78.84 ÷ 1.04 = 75.81.

The bond trades at 70 and is worth 75.81, assuming the expected default probability and recovery rate given above, so the distressed debt investor should view this opportunity as potentially profitable.

4 OTHER SPECIAL SITUATIONS

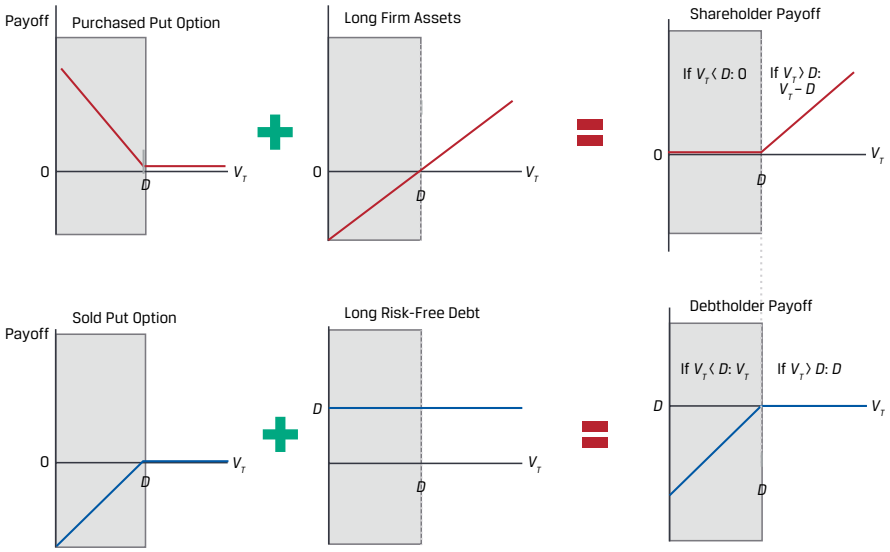
☐ discuss the features of complex investment situations involving financial dislocation or stress

Financial distress arises as the value of an issuer's assets (V_T) declines compared to the face value of its debt (D). More complex investment situations associated with a company's capital structure require a closer examination of the building blocks of firm value.

Equity as an Option of Firm Assets: The Merton Model

As shown in Exhibit 1, a firm's value combines shareholder and debtholder claims. In theory, shareholder claims consist of assets (V_T) plus the right to deliver or "put" assets to debtholders upon default at an exercise price of D (p_0 at $t = 0$). Debtholders have a risk-free debt claim at maturity (D) plus the put option ($-p_0$) *sold* to shareholders. These components of firm value distributed between shareholders and debtholders are illustrated in Exhibit 13.

Exhibit 13: Shareholder and Debtholder Payoffs at Time *T*



Earlier in the curriculum, it was shown that under put–call parity, at $t = 0$, the price of a long underlying asset plus a long put option must equal the price of a long call option plus the present value of a risk-free bond's face value (D) equal to the option exercise price. Substituting firm asset value as the asset and risk-free debt for the risk-free asset, we can show firm asset value under put–call parity (V_0) as

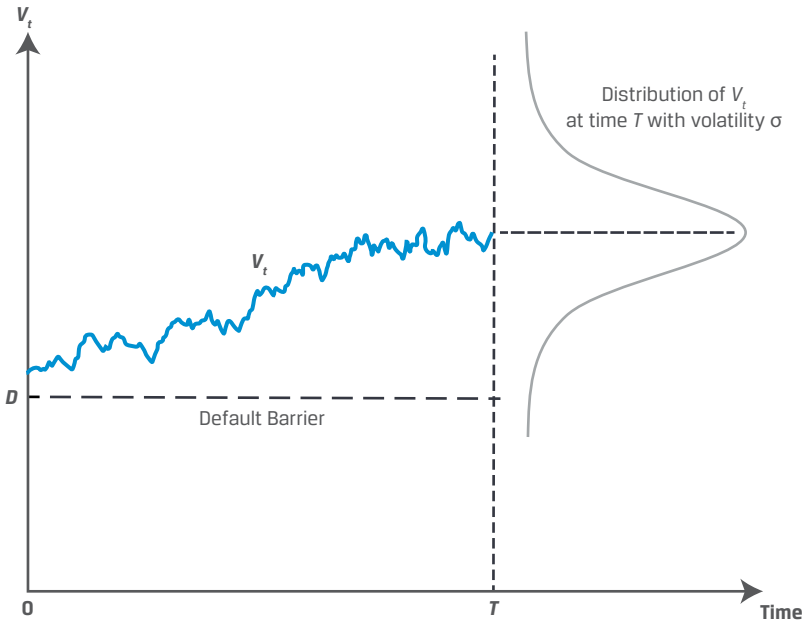
$$V_0 + p_0 = c_0 + \text{PV}(D).$$

$$V_0 = c_0 + \text{PV}(D) - p_0. \tag{2}$$

In Equation 2, the *shareholder* payoff is shown as a call option on firm value (c_0), while the debtholder payoff is equal to risk-free debt, PV(D), and the sold put ($-p_0$). This sold put option may be interpreted as the firm's *credit spread*, or the premium above the risk-free rate shareholders must pay debtholders to assume default risk.

This link between credit spreads to equity prices is the key feature of **structural credit risk models** introduced earlier in the curriculum. Structural models, or models using an option-based approach to evaluate a firm's market value of assets versus its fixed obligations, are commonly applied to evaluate default probabilities and complex investment situations. Exhibit 14 shows the features of a structural model, with the market value of equity, E_t, over time based on the market value of firm assets (V_t), a probability distribution based on asset value volatility (σ) and the face value of debt(D), also referred to as the default barrier.

Exhibit 14: Structural Model of Default



At time T, equity and debt values are as follows:

$$V_T = E_T + D_T, \tag{3}$$

where

$$E_T = \max[(V_T - D_T), 0] \tag{4}$$

$$D_T = V_T - \max[(V_T - D_T), 0] \tag{5}$$

Equation 3 shows firm asset value divided between equity and debt. Equityholders own a call option on residual assets (Equation 4), while debtholders own a covered call position on the firm's asset value (Equation 5).

Structural models are also often referred to as Merton models, because they are based on the same work and apply the same Black–Scholes–Merton (BSM) option pricing model introduced in an earlier learning module on derivatives. Since equity value E_t may be expressed as a call option on residual firm value $(V_t - D)$, we substitute this expression for the familiar $(S - X)$ denoting the stock price minus the exercise price used in the original BSM model. This theoretical application of the BSM model also uses the volatility of the value of the firm's assets rather than that of the firm's equity:

$$E_t = V_t N(d_1) - e^{-rT} D N(d_2), \tag{6}$$

where

$$d_1 = \frac{\ln(V_t/D) + [r + (1/2)\sigma^2](T - t)}{\sigma\sqrt{T - t}}$$

$$d_2 = d_1 - \sigma\sqrt{T - t}$$

$N(x)$ denotes the probability of obtaining a value of less than x based on a standard normal distribution. Debtholders expect to receive D at maturity, while the value of *risky* debt prior to maturity at time t (D_t) simply equals the difference between firm asset value (V_t) and equity value (E_t):

$$D_t = V_t - E_t. \tag{7}$$

Ignoring spread adjustments due to liquidity or other factors, the difference between the present value of risk-free debt ($e^{-rT}D$) and risky debt (D_t) represents the put option on firm value described earlier. The "price" of the put option is the present value of expected loss, or credit valuation adjustment.

Risky bond and CDS values are more easily compared when the put option price is shown as a spread over risk-free debt rather than based on the difference in present value of zero-coupon debt. The put option expressed as a periodic credit spread, or the difference between a risky yield R and the risk-free rate r, is shown in Equation 8 for a maturity of $T - t$.

$$R - r = \frac{1}{T-t}\left(\ln\left[\frac{D}{D_t}\right]\right) - r. \tag{8}$$

Since D_t is equal to face value of debt minus the value of the put option, we can see that the more valuable the put option, the higher the credit spread ($R - r$) becomes. Because of put–call parity, greater call option value implies greater put option value (i.e., higher equity value and lower debt value relative to asset value). These structural model relationships are illustrated in the following case study.

CASE STUDY

Cedere Corporation Equity and Debt Values Using a Structural Model

An analyst estimates that Cedere Corporation, a publicly traded company with 10 million shares outstanding, has assets with a market value of EUR3.25 billion and an estimated asset volatility of 20%. She observes that Cedere currently has a face value of EUR2.75 billion in debt outstanding and that the current risk-free euro interest rate is 5%.

1. Assuming a one-year time horizon, use the structural model to estimate the value of Cedere's equity, its risky debt, and its credit spread.

   Solution:

   Solve for Cedere's equity value using Equation 6:

   $$E_t = V_t N(d_1) - e^{-rT} D N(d_2).$$

   $$E_t = 3{,}250 \times N(d_1) - e^{-0.05} \times 2{,}750 \times N(d_2).$$

   $$d_1 = \frac{\ln(3{,}250/2{,}750) + (0.05 + (1/2)0.2^2)}{0.2} = 1.18527.$$

   $$d_2 = d_1 - 0.2 = 0.98527.$$

   Use the spreadsheet function NORM.S.DIST(*z*,*cumulative*) to solve for $N(d_1)$ and $N(d_2)$ given the respective values:

   $$N(d_1) = 0.88204 = \text{NORM.S.DIST}(1.18527,\textit{true}).$$

   $$N(d_2) = 0.83775 = \text{NORM.S.DIST}(0.98527,\textit{true}).$$

   Substituting these values into Equation 6, solve for E_t of EUR675 million, or a price per share of EUR67.50 (EUR675 million/10 million).

   Solve for Cedere's risky debt value using Equation 7:

   $$D_t = 3{,}250 - 675 = \text{EUR2.575 billion}.$$

   Solve for Cedere's implied credit spread using Equation 8:

$$R - r = \frac{1}{T-t}\left[\ln\left(\frac{2,750}{2,575}\right)\right] - 0.05.$$

Solve for $R - r$ of 1.58% p.a.

2. Discuss how Cedere's equity, debt, and credit spread values change if the market value of the firm's assets were to fall to EUR2.5 billion.

Solution:

A decline in Cedere's market value of assets (V_t) from EUR3.25 billion to EUR2.5 billion would reduce the value of a call option on residual assets ($V_t - D$), reducing the value of equity and increasing the value of the put option and the credit spread. We can calculate the impact of this change as follows:

Solve for Cedere's equity value using Equation 6:

$$E_t = 2,500 \times N(d_1) - e^{-0.05} \times 2,750 \times N(d_2).$$

$$d_1 = \frac{\ln(2,500/2,750) + (0.05 + (1/2)0.2^2)}{0.2} = -0.12655.$$

$$d_2 = d_1 - 0.2 = -0.32655.$$

Use the spreadsheet function NORM.S.DIST(*z*,*cumulative*) to solve for $N(d_1)$ and $N(d_2)$ given the respective values:

$N(d_1) = 0.44965$ = NORM.S.DIST(–0.12655,*true*).

$N(d_2) = 0.37200$ = NORM.S.DIST(–0.32655,*true*).

Substituting these values into Equation 6, solve for E_t of EUR151 million, or a price per share of EUR15.10 (EUR151 million/10 million).

Solve for Cedere's risky debt value using Equation 7:

$D_t = 2,500 - 151$ = EUR2.349 billion.

Solve for Cedere's implied credit spread using Equation 8:

$$R - r = \frac{1}{T-t}\left[\ln\left(\frac{2,750}{2,349}\right)\right] - 0.05.$$

Solve for $R - r$ of 10.76% p.a.

Note that the firm's share price fell but remained positive despite a decline in the market value of firm assets below the face value of debt ($V_t > D$). Consistent with an out-of-the-money call option on firm value, the positive equity price represents time value given the underlying volatility of asset prices.

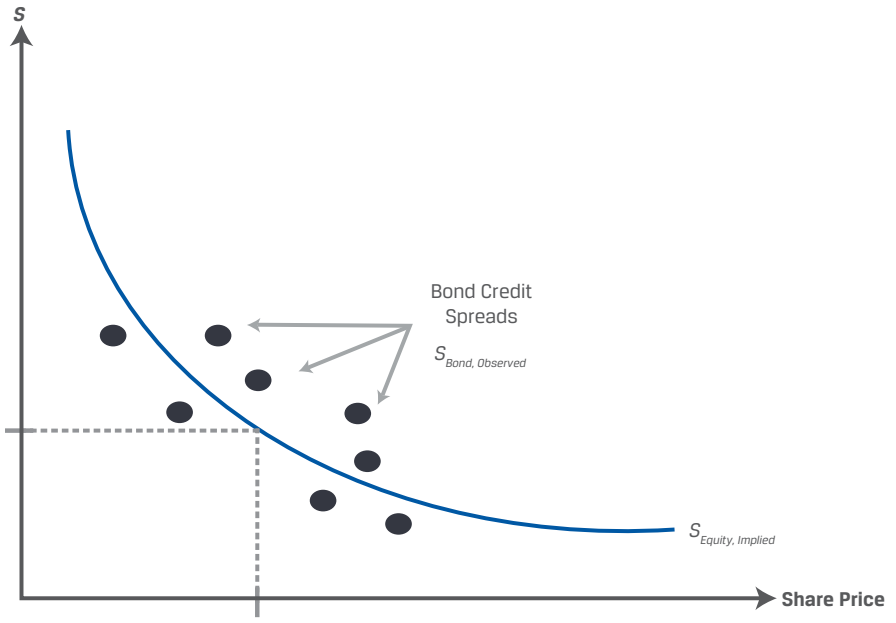
Insights gained from structural models must be weighed against their limitations. In practice, the market value of a firm's assets and asset price volatility are not directly observable but instead are estimated using equity prices and equity volatility. Debt profiles with staggered maturities, different levels of seniority and security, and contingency features complicate the put option calculation, and it is difficult to calibrate models to sudden capital structure changes. Continuous trading and no-arbitrage pricing assumptions do not apply to firms in financial distress with less liquid debt and equity securities. In practice, the default probabilities and credit spreads resulting from the Merton model may require adjustments based on historical data or other factors to arrive at a default probability forecast. As a result, while useful in quantifying equity implied credit risk, structural models are usually complemented by other credit and equity valuation models and techniques.

Capital Structure Arbitrage and the Merton Model

As described earlier, capital structure arbitrage strategies involve taking more than one position, typically a long and a short position, to capitalize on security mispricing in different markets for the same issuer. Discrepancies may arise due to the presence of different participants in equity, bond, loan, and CDS markets, as well as varying speeds of price adjustment.

Structural models are used as a basis to compare implied credit spreads across equity, bond, and CDS markets and predict changes based on market movements. For example, we showed that an implied credit spread from the equity value (or $S_{Equity,Implied}$) is equal to $(R - r)$, where R is the yield-to-maturity on an issuer's debt and r is the applicable risk-free rate. We can derive implied credit spreads over a range of equity prices and compare them to observed bond market spreads ($S_{Bond,Observed}$) based on traded prices as shown in Exhibit 15.

Exhibit 15: Model Results vs. Observed Bond Credit Spreads



The relationship between an issuer's equity price and its implied credit spread shown in the graph was established using a structural model. The downward-sloping curve reflects the fact that as share prices rise, the likelihood of default falls and credit spreads narrow. The data points above and below the curve represent spreads derived from the issuer's bond prices ($S_{Bond,Observed}$).

Under the assumption that the price of credit risk between implied credit spreads from equity and bond spreads should generally be aligned ($S_{Equity,Implied} \approx S_{Bond,Observed}$), a simple capital arbitrage decision rule to take advantage of *relative* mispricing between implied equity and bond spreads is as follows:

$S_{Bond,Observed} > S_{Equity,Implied}$: Buy bonds, sell equity short

$S_{Equity,Implied} > S_{Bond,Observed}$: Buy equities, sell bonds short

If the observed bond spread $S_{Bond,Observed}$ exceeds the spread implied by the model, then the value of debt, D_t, and thus the bond price are *below* that predicted by the model. An investor who buys the bond and sells the stock short expects to gain as the mispricing ($S_{Bond,Observed} - S_{Equity,Implied}$) falls to zero.

A final consideration is the hedge ratio of this capital arbitrage strategy. Assuming the Merton model accurately represents the default probability, as in the case of other options, we can use the BSM model to derive the delta, or expected change in bond value for a given change in equity value, dD_t/dE_t, to determine this ratio as follows, using Equation 7:

$$\frac{dE_t}{dV_t} = N(d_1) \; ; D_t = V_t - E_t.$$

$$\frac{dD_t}{dE_t} = \frac{dV_t}{dE_t} - 1 = \frac{1}{N(d_1)} - 1. \tag{9}$$

We consider a capital arbitrage strategy using the earlier case study.

CASE STUDY

Cedere Corporation Bond vs. Equity Capital Arbitrage Strategy

Recall that Cedere Corporation is a publicly traded company with 10 million shares outstanding. Cedere currently has one-year debt with a face value of EUR2.75 billion outstanding, and the current risk-free euro interest rate of 5% remains constant for the period under consideration.

1. Assuming a firm asset volatility of 20%, calculate the implied equity credit spread over a range from EUR10 to EUR100 per share using the structural model and interpret the results under the Merton model.

   Solution:

   Using the BSM model in Equation 6 and given that D equals EUR2.75 billion, r is 5%, σ = 0.2, and T is 1, we can solve for a given E_t, which when divided by 10 million gives us the respective price per Cedere share. For example, a EUR10 price per share implies E_t of EUR100 million. Solve for $\text{Spread}_{Equity,Implied}$:

   $$\text{EUR100 million} = V_t N(d_1) - e^{-0.05} 2.75 \text{ billion } N(d_2),$$

   where

   $$d_1 = \frac{\ln(V_t/2.75 \text{ billion}) + [0.05 + (1/2)0.2^2](1)}{0.2}.$$

   $$d_2 = d_1 - 0.2$$

   Solve for V_t = EUR2.372 million by an iterative process, such as trial and error or the Goal Seek function in Excel.

   lve for D_t using Equation 7:

   D_t = 2,372 – 100 = EUR2.272 billion.

   Solve for Cedere's implied credit spread using Equation 8:

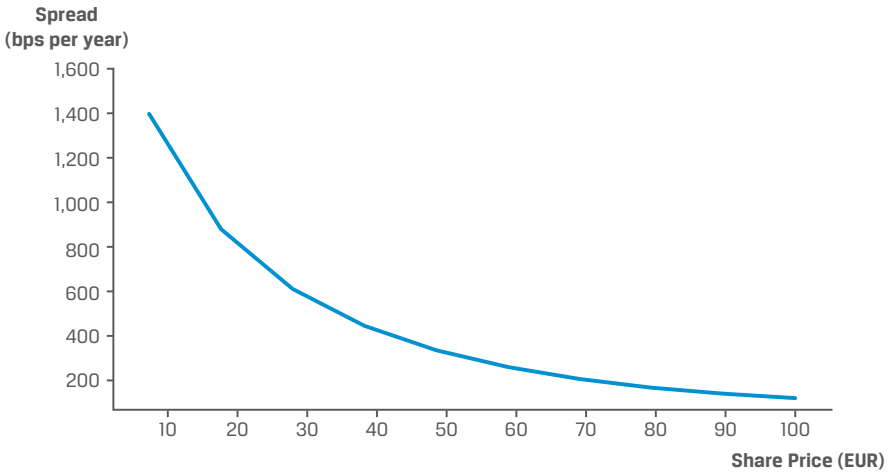
   $$R - r = \frac{1}{T-t}\left[\ln\left(\frac{2,750}{2,272}\right)\right] - 0.05.$$

   Solve for $\text{Spread}_{Equity,Implied} = R - r$ of 14.09% p.a.

Using a spreadsheet to set up the calculation of Equations 6, 7, and 8, we can use a Data Table or Goal Seek function to solve for $\text{Spread}_{Equity,Implied}$ as a function of Cedere's equity price per share, as shown in the following table and Exhibit 16.

Cedere Equity Price (EUR)	$\text{Spread}_{Equity,Implied}$ (% p.a., σ = 20%)
10	14.09%
20	8.60%
30	5.75%
40	4.00%
50	2.83%
60	2.03%
70	1.46%
80	1.05%
90	0.76%
100	0.55%

Exhibit 16: Cedere Implied Credit Spread vs. Equity Prices



2. Assume an analyst observes that Cederes' shares are trading at EUR40 and its one-year zero-coupon debt is available for purchase at a price of EUR90 per EUR100 face value. Analyze the potential for capital structure arbitrage, and recommend a trading strategy incorporating an appropriate hedge ratio.

Solution:

Cedere's firm value is EUR2,875 million given equity value of EUR400 million (= EUR40 per share × 10 million shares) and debt value of EUR2,475 million (= 90% × EUR2,750).

Using Cedere's firm value of EUR2,875, we continue to assume that D equals EUR2,750 million, r is 5%, σ = 0.2, and T is 1. Next, we solve for d_1 and d_2:

$$d_1 = 0.5723 = \frac{\ln(2.875/2.75 \text{ billion}) + [0.05 + (1/2)0.2^2](1)}{0.2}.$$

$$d_2 = 0.3723 = 0.5723 - 0.2.$$

Then, we solve for $N(d_1)$ and $N(d_2)$ given the respective values:

$N(d_1) = 0.7164 = \text{NORM.S.DIST}(0.5723,\textit{true})$.

$N(d_2) = 0.6451 = \text{NORM.S.DIST}(0.3723,\textit{true})$.

Using this information in Equation 6 to solve for Cedere's equity value (i.e., the call option value):

$E_t = 2{,}875 \times 0.7164 - e^{-0.05} \times 2{,}750 \times 0.6451 = 372$.

Thus, Cedere's equity value according to the structural model is EUR372 million, which compared to the current traded price of EUR400 million suggests that Cedere's equity is overvalued. Subtracting Cedere's model equity value of EUR372 million from the asset value of EUR2,875 million implies a fair value of debt of EUR2,503 million, which implies the traded value of EUR2,475 is undervalued.

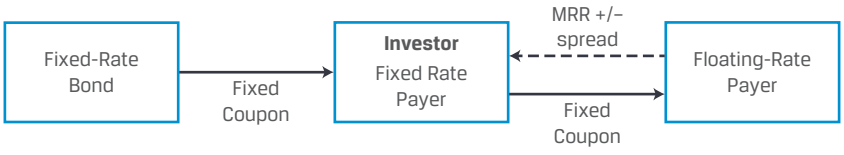
Therefore, there appears to be potential for a capital structure arbitrage by buying Cedere's bonds and selling short the company's stock.

To construct the trade, we use Equation 9 to find the hedge ratio (i.e., change in debt value per change in equity value), and we use the $N(d_1)$ term from the BSM model of 0.7164 to calculate a ratio of 0.3958 [= (1 ÷ 0.7164) − 1]. So, per EUR1 of bond value purchased, sell short EUR0.3958 in equity value.

The prior case study assumed a constant risk-free rate, but fixed-coupon bond prices change as both the level of interest rates and the market's view of an issuer's credit risk changes. Investors use interest rate hedging strategies, such as an **asset swap**, to isolate a bond's spread component.

Exhibit 17 shows a bond's periodic fixed coupon to a market reference rate MRR plus (or minus) a spread using an asset swap.

Exhibit 17: Asset Swap Mechanics

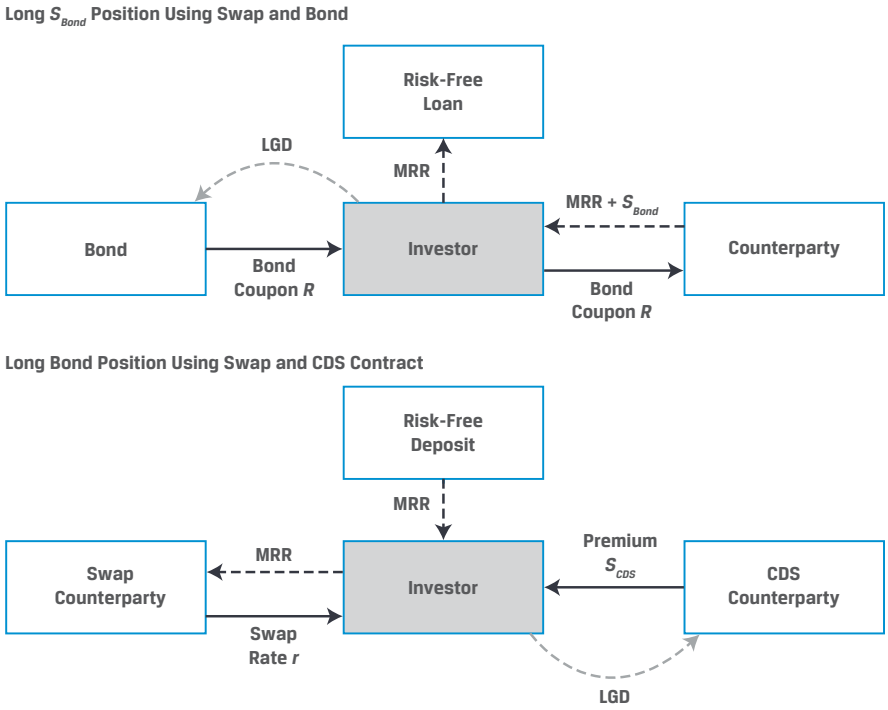


If we assume an investor purchases a risky bond at par, the asset swap transforms the risky fixed-rate coupon to an equivalent fixed credit spread over MRR for the life of the bond. As the swap offsets bond value changes due to interest rate risk, the combination of risky bond and pay-fixed swap exposure leaves the investor with price risk based on bond credit spread (S_{Bond}) changes. However, note that under a bond default scenario, the investor still faces a mark-to-market settlement of the pay-fixed asset swap.

Recall from earlier that a credit default swap is a derivative contract in which a protection *buyer* pays a periodic premium based on the CDS spread at inception to a protection *seller*. The seller makes a contingent payment equal to the difference between par and the recovery rate to the buyer under a credit event. Unlike interest rate swaps, credit default swaps are terminated and settled after a credit event, with no remaining interest rate swap exposure.

Under the no-arbitrage assumption that an investor can both borrow and lend at MRR as a reasonable approximation of the risk-free rate, *r*, Exhibit 18 illustrates the use of these strategies in taking a synthetic position in an issuer's bond or credit spread.

Exhibit 18: Bond vs. CDS Strategies in Managing Issuer Spread Risk



In the first instance, we demonstrate that an investor can create a long bond spread (S_{Bond}) position by borrowing at MRR for the life of the debt, buying the bond, and entering a pay-fixed interest rate swap. Alternatively, an investor may create a synthetic long bond position to earn the total rate of return, *R*, by depositing the bond purchase at a risk-free rate, selling CDS protection, and entering a receive-fixed swap. The cash flows of these two approaches are summarized in Exhibit 19.

Exhibit 19: Synthetic Bond Spread and Synthetic Bond Cash Flows

Cash Flows	Synthetic S_{Bond}	Synthetic Bond with CDS
At Inception	Borrow D	Lend D
	Purchase bond for D	Enter receive-fixed swap
	Enter pay-fixed swap	Sell CDS protection
	Net: 0	**Net: $-D$**
Periodic Cash Flows	Bond: + R	Deposit: + MRR
	Swap: + MRR + $S_{Bond} - R$	Swap: + r – MRR
	Loan: – MRR	CDS: + S_{CDS}
	Net: + S_{Bond}	**Net: + $(r + S_{CDS}) \approx R$**

Cash Flows	Synthetic S_{Bond}	Synthetic Bond with CDS
At Maturity	Bond: Receive D	Loan: Receive D
	Loan: Pay D	
	Net: 0	**Net: *D***

Arbitrage potential between these strategies is eliminated when bond and CDS spreads are closely aligned ($S_{Bond} \approx S_{CDS}$). In practice, a bond and CDS spread difference, or **CDS basis**, may arise due to bond price differences from par, accrued interest, and varying contract terms. For example, in the case of a *negative* CDS basis (where $S_{Bond} > S_{CDS}$), an investor might combine a synthetic long S_{Bond} position, shown above, with *buying* CDS protection on the same issuer to benefit as the basis declines over time.

As a protection *seller* realizes a mark-to-market *gain* when CDS spreads *narrow*, the position is equivalent to a long bond position. Capital structure arbitrage trades to take advantage of *relative* mispricing between implied equity and CDS spreads may be summarized as follows:

If:	Then:
$S_{CDS} > S_{Equity,Implied}$:	Sell CDS protection, sell equity short
$S_{Equity,Implied} > S_{CDS}$:	Buy equities, buy CDS protection

We have considered changes in implied asset values, as well as changes in equity values, to motivate capital structure arbitrage opportunities. However, these examples have assumed fixed volatility over time. Volatility changes in the structural model add a third dimension that may create capital structure arbitrage opportunities. We first consider how a volatility change affects the equity price versus implied credit spread relationship by revisiting our earlier case study.

CASE STUDY

Cedere Corporation Bond vs. Equity As Asset Volatility Changes

Cedere Corporation has 10 million shares and EUR2.75 billion in one-year debt outstanding. Rising uncertainty in Cedere's industry has caused the analyst to double the asset volatility assumption in her structural model to 40%.

1. Assuming a risk-free rate of 5%, calculate the implied equity credit spread for a share price of EUR10 per share using the revised structural model volatility assumption, and interpret the results.

   Solution:

   Using the BSM model in Equation 6 with D = EUR2.75 billion, r = 5%, σ = 0.4, and T = 1, solve for Spread$_{Equity,Implied}$ given E_t of EUR100 million (EUR10 per share):

   $$\text{EUR100 million} = V_t N(d_1) - e^{-0.05} 2.75 \text{ billion } N(d_2),$$

   where

   $$d_1 = \frac{\ln(V_t/2.75 \text{ billion}) + [0.05 + (1/2)0.4^2](1)}{0.4}$$

$d_2 = d_1 - 0.4$

Solve for V_t = EUR1.878 billion using an iterative approach as in the prior case study, and note a comparison to EUR2.372 billion when 20% volatility was assumed.

Solve for D_t using Equation 7:

$D_t = 1{,}878 - 100 = \text{EUR}1.778 \text{ billion}.$

Solve for Cedere's implied credit spread using Equation 8:

$$R - r = \frac{1}{T-t}\left[\ln\left(\frac{2{,}750}{1{,}778}\right)\right] - 0.05.$$

Solve for $\text{Spread}_{Equity,Implied} = R - r$ = 38.64% (versus 14.09% with 20% volatility).

The value of the call option held by shareholders on firm assets *rises* as volatility increases, causing the present value of firm assets at time t (V_t) to be lower for a given equity price and increasing the value of the put option sold by debtholders, both reducing the debt value (D_t) and increasing the credit spread ($R - r$) expressed as a percentage.

2. Revisit the arbitrage strategy used in Question 2 in the prior case study, and discuss an alternative interpretation of how a volatility change may impact the outcome.

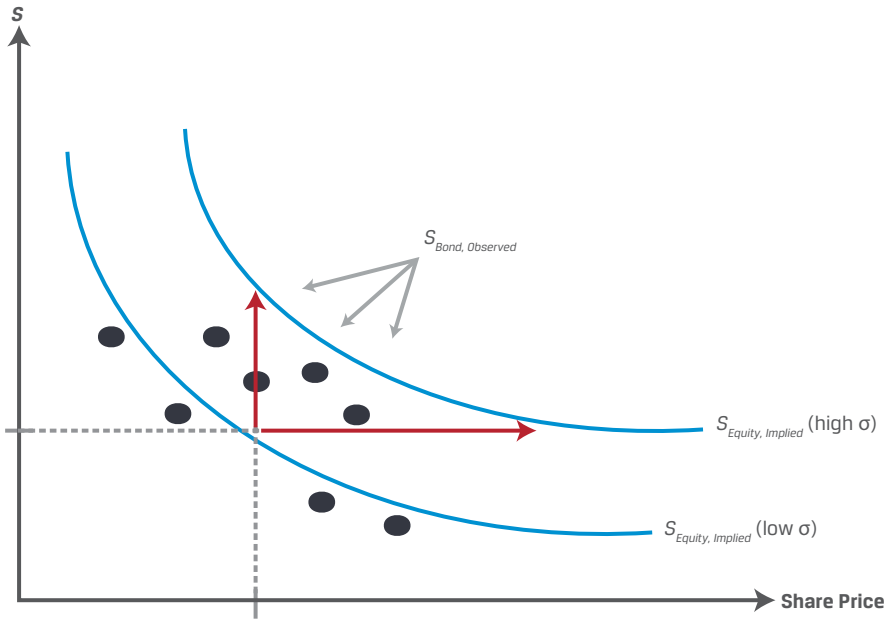
Solution:

As Cedere's assumed asset volatility increases, the company's option values increase, holding asset value constant. Specifically, volatility increases imply higher fair values for Cedere's equity while the company's fair value of debt decreases, thus increasing the implied credit spread on Cedere's risky debt.

In a higher-volatility environment, Cedere's equity and debt values may move sufficiently that the company's stock becomes undervalued, and the debt overvalued. In fact, in the scenario of Question 2 in the prior case study, volatility above approximately 22.8% (which may be viewed as the implied asset volatility associated with Cedere's observed equity and debt prices) will create a situation in which the capital structure arbitrage would be to buy Cedere's shares and sell short the bonds.

An increase in volatility in the structural model leads to a shift in the equity price/implied bond spread relationship upward and to the right, as shown in Exhibit 20.

Exhibit 20: Volatility and the Credit Spread/Share Price Relationship



This shift in the equity price/credit spread relationship increases the expected credit spread ($S_{Equity,Implied}$) for a given share price, changing the relative mispricing of observed trades based on the original volatility assumption. For example, in Exhibit 15, a short bond/long equity position would have realized a gain given the shift from low to high volatility and a new equity/credit spread relationship.

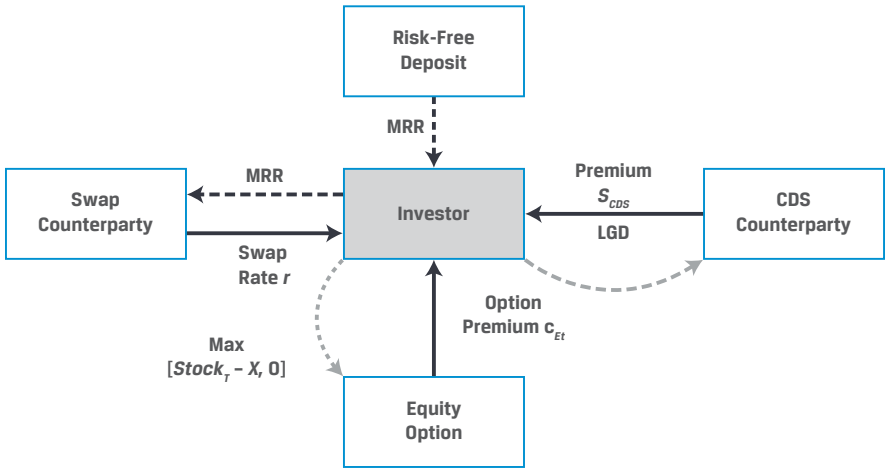
Investors may also take an explicit capital structure arbitrage position based on a view that the *implied* equity volatility suggested by the credit spread/share relationship in the structural model deviates significantly from actual equity volatility, as observed, for example, in the traded equity options market.

Convertible Bond Arbitrage Strategies

As described earlier in the curriculum, convertible bonds combine a straight bond with an embedded call option on an issuer's shares sold to investors. Investors may exchange debt into equity at a predetermined **conversion price** per share, or the price at which the debt may be fully exchanged for shares, during a period in the future.

Convertible bonds are relatively illiquid securities typically issued by early-stage or high-risk companies, with the call option contingency feature attracting lenders who may not be willing to offer standard fixed-rate debt to the issuer. Convertible bonds are also often offered at a discount to investors to attract capital more quickly than through a typical equity or bond offering. Exhibit 21 extends the earlier exhibit showing a straight bond's building blocks in terms of interest rate risk and credit risk to the case of convertible bonds.

Exhibit 21: Convertible Bond Building Blocks



Extending the earlier synthetic long bond example, an investor may create a synthetic long convertible bond position by depositing the bond purchase price at a risk-free rate, selling CDS protection, entering a receive-fixed swap, and purchasing an equity call option that matches the bond's conversion terms.

The convertible bond issuer has sold equity volatility to the investor, typically in the form of a lower debt coupon versus standard non-convertible debt. This is demonstrated in Exhibit 21 by the investor's initial outlay of the straight bond purchase price D plus the equity call option(c_{Et}), which is greater than D in Exhibit 13 for the case of standard fixed debt.

Two key differences exist for capital structure arbitrage in the case of convertible debt versus straight debt. First, in contrast to the *indirect* impact of equity volatility on the relationship between credit spreads and share prices in the structural model, convertible bond investors hold a long equity volatility position in the form of an embedded call option. Increasing volatility results in gains to the convertible bondholder due to increases in value on the embedded call option. Second, the conversion feature associated with convertible bonds imposes arbitrage bounds on convertible bonds that do not exist in the case of straight bonds under the structural model. A wide range of capital arbitrage strategies may be used to isolate or offset equity, volatility, credit, and other exposures related to convertible bonds, three of which are listed below.

- *Credit risk.* An investor can purchase CDS protection to offset convertible bond issuer default risk.
- *Interest rate risk.* An investor can pay fixed on an interest rate swap to convert the fixed-rate exposure on the convertible bond to MRR.
- *Equity volatility risk.* An investor can use short equity positions or equity put options to hedge the equity market position of the convertible bond.

QUESTION SET

Laborantibus Partners manages a private fund specializing in distressed securities and is considering investments in public securities issued by Fracassar PLC, a British hotel chain encountering financial problems. Fracassar owns assets with a market value estimate of GBP6,500 million and has GBP7,500 million of zero-coupon debt outstanding that is scheduled to be repaid in six

months (i.e., half of a year). Laborantibus estimates that Fracassar's annualized asset volatility is 50%. The current annualized risk-free rate is 5%. Based on this information, Laborantibus builds a structural model to estimate Fracassar's credit risk. As an analyst, you observe the following output from a spreadsheet estimate from this model.

Variable	Estimated Value
d_1	–0.1573
d_2	–0.5108
$N(d_1)$	0.4375
$N(d_2)$	0.3047
Call option value	GBP615 million

1. Calculate the estimated current value of Fracassar debt and the company's credit spread based on the results of the structural model.

   Solution:

   Fracassar's equity value is equal to the call option value of GBP615 million. So, Fracassar's debt value is GBP5,885 million (= 6,500 – 615), using Equation 7.

   Next, we solve for Fracassar's implied credit spread using Equation 8:

   $$R - r = \frac{1}{0.5}\left[\ln\left(\frac{7,500}{5,885}\right)\right] - 0.05.$$

   $R - r$ equals 43.49%, which reflects Fracassar's implied credit spread.

2. Laborantibus observes the actual credit spread on Fracassar's bonds is 40.0% and their price is GBP5,885. Which of the following best describes a potentially profitable capital structure arbitrage strategy?

   A. Buy Fracassar equity, and sell short Fracassar bonds.

   B. Buy Fracassar bonds, and sell short Fracassar equity.

   C. Buy Fracassar bonds, and buy Fracassar equity.

   Solution:

   A is the correct response. As shown in the solution to the prior question, a bond price of GBP5,885 implies a credit spread of 43.49%. When the observed credit spread is lower than the implied equity spread, the capital structure arbitrage strategy involves selling short bonds and buying equity. The investor expects spreads to widen to those implied by the structural model, causing the bonds to fall in value relative to equity. B is incorrect because it would be an appropriate strategy if the observed credit spread were greater than the implied credit spread. C is incorrect because this strategy implies that both securities are underpriced, which is not consistent with the structural model, because the two securities can only be mispriced in the opposite direction (i.e., one undervalued and the other overvalued).

3. Laborantibus revises its assumption about Fracassar's asset value given that it observes the market prices of Fracassar's equity and debt are GBP600 million and GBP6,000 million, respectively. The structural model is recal-

culated, and outputs of the model are shown below. Recommend a capital structure arbitrage strategy incorporating an appropriate hedge ratio.

Variable	Estimated Value
d_1	–0.1141
d_2	–0.4676
$N(d_1)$	0.4546
$N(d_2)$	0.3200
Call option value	GBP659 million

Solution:

Given that Fracassar's equity is valued at GBP659 million and can be purchased for GBP600 million, the equity is undervalued by GBP59 million. Thus, Fracassar's debt is overvalued by GBP59 million. The capital structure arbitrage strategy is to buy Fracassar equity and sell Fracassar debt.

To construct the trade incorporating the hedge ratio, we use Equation 9 to find the hedge ratio, and we use the $N(d_1)$ term from the BSM model of 0.4546 to calculate a ratio of 1.1998 [= (1 ÷ 0.4546) – 1]. So, per GBP1 of bond value sold short, buy GBP1.1998 of equity.

4. While Laborantibus believes that Fracassar's asset volatility will likely stay high, it has also built a scenario in which asset volatility declines considerably as uncertainty about the value of hotel asset fades. Which of the following capital structure arbitrage trades works best to capitalize on this scenario?

   A. Buy Fracassar equity, and sell short Fracassar debt.

   B. Sell short Fracassar equity, and sell short Fracassar debt.

   C. Sell Fracassar equity, and buy Fracassar debt.

Solution:

C is the correct response. A decline in asset volatility will reduce the call option value that is Fracassar's equity while the company's debt increases in value. A is incorrect because this strategy is appropriate in the event of increasing volatility. B is incorrect because this strategy is not an arbitrage; it is simply a bearish strategy on firm value.

SPECIAL SITUATIONS DUE DILIGENCE AND VALUATION

5

☐ discuss the due diligence and valuation processes used to evaluate special investment situations

Special Situations Due Diligence

The types of market-, industry-, and issuer-specific information gathered and analyzed in the due diligence process for special situations investments is similar to that described in earlier Private Markets Pathway learning modules. Recall that more detailed analysis is common in private versus public markets given the role of analysis in establishing a business plan for value creation over a relatively long holding period rather than for short-term trading purposes.

Given the relatively short-term, cyclical, and/or event-driven nature of distressed situations, investors typically have far less time to conduct due diligence and evaluate prospective investments. As a result, screening opportunities to prioritize specific investments is a critical initial step in the process. Key criteria such as issuer ratings, company size based on market capitalization, observed market prices of distressed bonds, and leverage ratios, such as debt/EBITDA, can help narrow investor focus on fewer targets whose debt is currently priced lower than expected based on observed financial ratios.

Statistical credit analysis models to measure creditworthiness often use the structural credit models introduced earlier or **reduced form models**. Unlike structural models, such as the Merton Model, reduced form models are not based on capital structure assumptions. Reduced form models provide a probability of default over a specific time frame, typically using observable company-specific variables, such as financial ratios, and market-based measures. An early example of the reduced form approach is the **Z-score** established by Edward Altman, which includes the following factors:

Liquidity: Working capital/total assets

Profitability: Retained earnings/total assets

Asset efficiency: EBIT/total assets

Market to book: Market value of equity/book value of equity

Asset turnover: Sales/total assets

These factors are weighted by coefficients to form a composite, or Z-score, used to classify firms into those expected to remain solvent versus bankrupt firms.

The structural models introduced earlier are also applied to estimate an issuer's probability of default to be considered along with the expected loss given default when evaluating the price of a distressed issuer's securities. Structural credit models used by practitioners include Moody's Analytics' Expected Default Frequency (EDF) and Bloomberg's Default Risk (DRSK) models, both of which estimate an issuer's probability of default over a selected period. For example, the DRSK model estimate includes a market-based asset value measure derived from equity market capitalization, asset value volatility based on equity volatility, and a default threshold measured using the book value of liabilities. Exhibit 22 shows the Bloomberg DRSK screen for the Swedish real estate firm SBB, described earlier, which estimates a one-year POD of 14.41%.

Exhibit 22: Bloomberg DRSK Model for SBB

Source: Bloomberg.

Other important differences from the private markets due diligence process are the relative lack of information available to investors compared to a typical corporate acquisition and the more rapid change in a company's financial conditions due to market- or company-specific events.

For example, short-term, trading-based investors, such as credit hedge funds, are best positioned to capitalize on temporary mispricing due to forced sales among institutional investors. These short-term investors are typically limited to public information and have a greater focus on the relative liquidity of instruments under consideration given the higher price volatility associated with these investment opportunities.

Longer-term investors seeking to engage in the restructuring process via either a controlling or non-controlling stake use the due diligence process to gauge their influence over the outcome of a reorganization and ability to create value as the issuer emerges from bankruptcy. In some instances, an investor may establish a small initial investment position in a company because initial due diligence suggests an attractive buying opportunity. Over time, the investor may continue to build the position if ongoing due diligence suggests that a controlling stake is appropriate, while in other cases, the investor may trade the position or retain a minority position.

Valuable information for these prospective investors, such as customer lists, sales projections, or commercial contracts, is likely to be non-public, and company management may be unwilling or unable to share it with outsiders in times of distress. In other cases, access to restricted information may be limited to a bank or lending group and only available to existing creditors under a confidentiality agreement. Limitations on the use of confidential non-public information may restrict trading in public securities and other activities. In this situation or when no such lending group exists, prospective investors have limited bargaining power to obtain this information.

In addition to the financial due diligence common among private investments, including financial statement analysis, cash flow projections, and industry and competitive analysis, evaluation of distressed issuers should include a worst-case liquidation scenario in which the company is dissolved and its assets are sold individually rather than as a going concern. For companies already in bankruptcy, a detailed review of the initial and subsequent bankruptcy court filings and ongoing monthly operating reports provides vital information about the firm's current unsecured creditors, short-term cash flow projections, inventory liquidations, and material events.

Legal due diligence for distressed companies should extend beyond the evaluation of organizational, legal commitments and outstanding litigation to include a thorough understanding of firm structure, as well as loan agreements and indentures within different legal entities, to identify any consolidation, structural, or financial issues or restrictions that may impact a creditor claim as the firm seeks or enters bankruptcy. For example, in contrast to fraudulent transfers described earlier in which assets are moved out of the reach of all creditors, an issuer may have granted a preference to one creditor over another, which may be reversed in bankruptcy court in what is known as a **voidable preference**.

Special Situations Valuation Approaches

Special situations investors make use of valuation techniques similar to those for public and private companies when considering an issuer as a going concern. In addition to the option-based structural model described in this learning module, techniques introduced earlier in the curriculum include the following:

- Income-based approaches based on discounted projected cash flows and a terminal value using assumed constant growth or a terminal market multiple
- Relative approaches (or the method of comparables) based on price-based or enterprise value–based multiples of firms with similar features
- Asset-based approaches seeking to estimate the value of underlying assets less liabilities

The key issue in valuing special situations is how to incorporate the likelihood, timing, and financial impact of specific events that give rise to investment opportunities. As described earlier in the curriculum, firms may face future alternatives that may be considered **real options** under a distressed scenario that can alter firm value. Recall that real options grant a firm the right but not the obligation to decide or take an action in the future. A company will choose to pursue (or exercise) a real option only if it enhances shareholder value. These options might include the sale of individual assets or an entire division of a firm. A related approach involves a **sum-of-the-parts valuation**, which considers the value of a firm's individual business segments if they were to be sold separately.

In what follows, we focus on events related to financial distress, such as bankruptcy, restructuring, and liquidation.

Consider how the potential for financial distress affects the standard discounted cash flow (DCF) valuation approach, as shown in Exhibit 23.

Exhibit 23: The Effect of Financial Distress on DCF Valuation

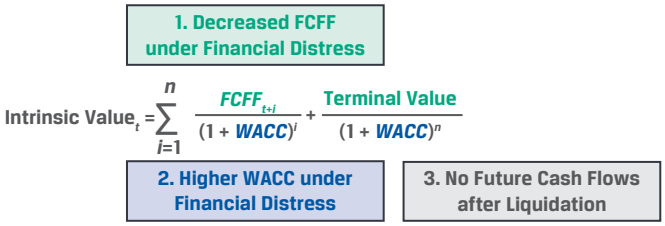


Exhibit 23 shows three key challenges associated with applying the standard DCF approach to the case of a distressed company:

- *"Numerator" issues.* Analysts must identify and adjust key balance sheet and income statement items due to expected financial distress affecting a company's normalized earnings. The timing and magnitude of event-driven changes to revenue and cash flow are difficult to estimate.
- *"Denominator" issues.* Rates of return used to discount future cash flows or earnings are a second challenge in a distress scenario. In addition to the relative illiquidity of debt and complex capital structures involved, recall that distressed debt yields are not reflective of an expected rate of return, since these bonds trade at a significant discount to par.
- *Terminal value issues.* Discounting future cash flows back to the present implies that a firm will remain a going concern, a questionable assumption in a case of financial distress. The assumption of a future terminal growth rate or market multiple based on non-distressed valuations results in further distortions when considering a firm that may be restructured or liquidated in the near term.

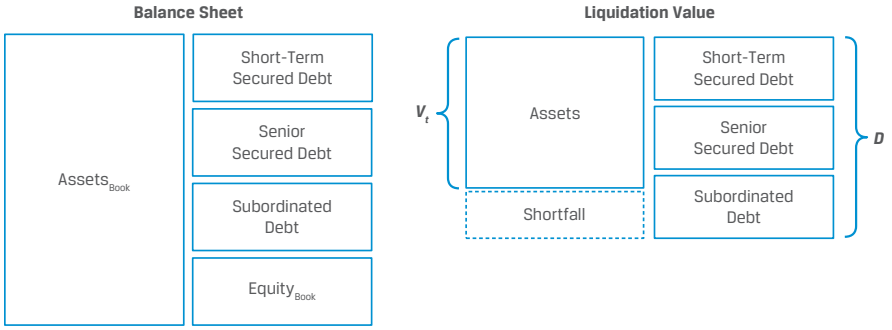
Relative value comparisons using market multiples also fail to adequately account for financial distress, because they are typically calculated using ratios from non-distressed industry peers. As in the case of exit multiples for private equity, a relative value approach can be applied if the firm is considered a going concern—that is, a scenario under which it has averted dissolution.

Asset-based valuation approaches hinge on whether the market value is estimated as part of an ongoing business—that is, incorporating the value of existing products, customers, suppliers, and relationships—or whether the assets are sold individually and separate from the business. As described earlier, if an issuer cannot restructure its activities and obligations to sufficiently meet creditor obligations as a going concern, the individual sale of its assets to settle claims is the best course of action. The liquidation value of a firm's assets therefore often represents a lower bound for valuation purposes.

Liquidation most often occurs when a firm is uncompetitive; its assets are inadequate, outdated, or in disrepair; or the company's management is ineffective. While specialized industry knowledge is critical in assessing asset values under these circumstances, little secondary market information exists for most fixed assets, and their sale price is highly dependent on whether a distressed or orderly sale process takes place.

Valuing a firm's outstanding securities under liquidation involves comparing the value of firm assets (V_t) to debt (D) based on the priority of claims. Exhibit 24 illustrates this scenario by contrasting the balance sheet with asset liquidation proceeds versus debt.

Exhibit 24: Liquidation Valuation Approach



The balance sheet on the left shows the book value of assets, equity, and debt, while on the right we see a shortfall ($V_t - D$) between asset liquidation values and debt. As a result, while senior secured lenders in this example will likely be repaid in full from liquidation proceeds, subordinated lenders will face a settlement value below the face value of debt. Consider the following liquidation valuation based on the earlier Maudville case study.

CASE STUDY

Maudville Corporation Liquidation Valuation

Recall that Maudville Corporation is a US chemical producer with USD5 billion in revenue and EBITDA of USD1 billion that was taken private for USD5 billion using debt (75%), equity (20%), and convertible preferred (5%) financing. After two years of profitability growth, operational improvements, and senior secured debt paydown, Maudville's revenue and profitability decline sharply in Year 3, leading to debt investor concerns over the company's financial situation entering Year 4. Maudville's remaining debt outstanding at the end of Year 3 is as follows:

Maudville Corp. Year 3 Debt Profile

Debt Tranche	Size	Tenor	Amortization	Terms and Conditions	Lender(s)
Secured Revolver	USD250 million	364 days		Secured by first lien	Syndicated bank group
Senior Secured Leveraged Loan	USD2.2 billion	Seven years		Secured by first lien; Ranks *pari passu* with other senior secured debt	Syndicated bank group
Junior Second-Lien Debt	USD600 million	Seven years	Amortizing in four equal installments starting Year 4	Secured by second lien; Ranks *pari passu* with other junior secured debt	100% Bardstown Credit Partners
Mezzanine Debt	USD500 million	10 years		Unsecured subordinated obligation; Ranks *pari passu* with all other subordinated indebtedness	50%: Bardstown Mezzanine Fund; 50%: Another GP. Bardstown has majority voting rights.

An analyst constructing an end-of-Year-4 liquidation scenario observes Year 3 total assets of USD5,596 million and goodwill of USD1,258 million. She assumes that Maudville has fully drawn down its secured revolver and that goodwill should be excluded from the value of assets sold under her presumed distressed liquidation scenario.

1. Calculate the expected recovery of Maudville's outstanding debt by tranche under the liquidation scenario if the analyst assumes that assets are sold for 60% of their Year 3 book value.

   Solution:

   Year 3 assets of USD5,596 million minus goodwill of USD1,258 million results in assets for sale of USD4,338 million, 60% of which gives us liquidation proceeds of USD2,602.6 million (= 0.6 × USD4,338 million). Total debt outstanding with the fully drawn USD250 million revolver is equal to USD3,550 million (3,550 = 250 + 2,200 + 600 + 500), leading to an *average* debt recovery upon liquidation of 73.3% (= 2,602.6/3,550). Using the priority of claims, we first apply USD2,450 million to the first-lien revolver and senior secured debt claim, with the remaining USD152.4 million (= 2,602.6 – 2,450) in proceeds used to settle 25.4% (= 152.4/600) of the USD600 million in second-lien claims. Expected recovery by tranche may be shown as follows:

   First lien: USD250 million revolver 100% recovery

   USD2,200 million senior secured 100% recovery

   Second lien: USD600 million junior second lien 25.4% recovery

   Unsecured: USD500 million mezzanine 0% recovery

2. Discuss the impact of the distressed liquidation scenario described above on the company's convertible preferred shares.

   Solution:

   Because preferred shareholders are paid only once all debtholder claims are satisfied, convertible preferred shareholder claims will be zero under the distressed liquidation scenario.

An alternative to the liquidation case in the previous case study is a going concern scenario, or valuation of the firm under the assumption that it survives and continues to operate. The advantage of this approach is the avoidance of the valuation pitfalls described earlier, which can cloud the analysis by attempting to incorporate event-driven changes of unknown timing and magnitude. While the path to returning to profitability and competitiveness may be far from certain, the advantage to this approach is the ability to use valuation metrics such as market multiples for healthy industry peers.

CASE STUDY

Maudville Corporation Going Concern Valuation and Scenario Analysis

The analyst evaluating Maudville's value at the end of Year 4 assumes that after a challenging period, the company is able to reach a normalized EBITDA of USD750 million in two years' time (Year 6).

1. Assuming the 6× EV/EBITDA industry multiple for Maudville's industry and using a risk-free discount rate of 5%, calculate the implied value of Maudville as a going concern at the end of Year 4.

   Solution:

   Given the assumed normalized EBITDA of USD750 million, we can solve for an enterprise value at the end of Year 6 of USD4,500 million (= 750 million × 6).

   Using a simple time-value-of-money calculation, we can solve for a present value of USD4,081.6 million at the end of Year 4.

   $$\text{PV} = \frac{\text{FV}_t}{(1+r)^t}.$$

   $$\text{USD4,081.6 million} = \frac{4,500}{(1.05)^2}.$$

2. Assuming a one-third probability of a distressed liquidation at the end of Year 4, solve for Maudville's enterprise value at the end of Year 4.

   Solution:

   Given the liquidation value as of the end of Year 4 of USD2,602.6 million from the earlier case study and the present value of Maudville as a going concern of USD4,081.6 million, we may solve for the implied enterprise value using a weighted average based on the assumed 33.3% likelihood of liquidation:

   USD3,588.6 million

   = (1/3) × USD2,602.6 million + (2/3) × USD4,081.6 million.

In practice, the default probability used in the simple scenario analysis shown in the case study may be derived from a structural or reduced form model, while the scenarios themselves may incorporate varying liquidation or restructuring assumptions. By isolating financial distress based on one or more specific scenarios and including a going concern recovery case in another, financial analysts can quickly tailor a valuation to changing market conditions.

QUESTION SET

1. Contrast the due diligence focus on distressed debt investments of credit hedge funds with investors looking to engage in the restructuring process.

   Solution:

   Credit hedge funds are short-term, trading-focused investors and will be focused on public information and the relative liquidity of credit instruments to assess their ability to take advantage of the price volatility. Investors engaged in the restructuring process are longer-term investors and use the due diligence process to assess how they may be able to influence the outcome of the reorganization process.

2. Explain the issues associated with estimating the cost of debt capital when valuing a distressed company using standard discounted cash flow analysis.

   Solution:

   The common approach to estimating the cost of debt capital used in the weighted average cost of capital (WACC) is to calculate a yield-to-maturity on the firm's debt. The yield-to-maturity reflects the promised rate of return on debt, rather than the expected rate of return, which incorporates expected loss E(L). As a result, the yield-to-maturity provides an inaccurate estimate of the cost of debt.

3. Discuss the potential for using each of the three standard approaches to company valuation for distressed companies.

   Solution:

   Income-based approaches are difficult to use for distressed companies because of challenges with numerator (i.e., cash flow), denominator (i.e., cost of capital), and terminal value estimates. Income-based approaches are best suited to valuing businesses that are a going concern. Thus, income-based approaches should be used only for distressed businesses with a high probability of continuing as a going concern.

   Relative valuations, or using comparables, may be complicated by the definition of a peer group. A non-distressed peer group may be suitable for estimating terminal value for a distressed company that has a high likelihood of continuing operations as a going concern. However, controlling for the near-term effects of distress may complicate the use of comparables.

   Standard asset-based valuation often determines the market value of a company under the assumption of continuing operations, while a distressed company likely to be liquidated should rather assume a liquidation value of the company's assets. As such, asset-based valuation is more appropriate where the company has a high probability of continuing operations, but liquidation value of assets should be used if there is a high probability of discontinuing operations.

SPECIAL SITUATIONS RISK AND RETURN

6

☐ discuss the risk and return among special situations and compared to other forms of private debt as part of a strategic asset allocation

Private market debt investment typically involves sub-investment-grade or unrated issuers and assets and often involves securities with restrictive covenants and contingencies such as callability or equity-like features. Macroeconomic, industry-specific, or company-specific events may create distressed circumstances for a subset of these investments, giving rise to idiosyncratic risks, but also the potential for higher return for investors who are able to fund these opportunities upon short notice if distress occurs.

To address these opportunities, private funds have increasingly initiated special situations funds to fund distressed firms while providing investors with acceptable risk-adjusted expected returns. Given their investment focus on distressed debt, special

situations funds are generally classified as a subset of private debt. As mentioned earlier, the market for private special situations funds is expected to grow to roughly half of the private debt market by 2027.

Institutional investors, such as pension plans, face an allocation challenge in their private debt strategies because they must assess a manager's ability to profit from the potentially higher risk associated with special situations funds as compared to other forms of private debt structure. While the issuers targeted by special situations funds typically face either a cyclical downturn or a steady deterioration in performance in a declining phase of their life cycle, fund GPs seek to navigate distressed situations to achieve returns from the following risk factors.

Credit Risk

Fund GPs expect portfolio assets to result in lower expected losses than those implied by their discounted purchase prices. Lower expected losses must reflect lower default rates or higher recovery rates in the event of default than expected as part of the restructuring process. That is, special situations fund GPs rely on their ability to either identify mispriced assets or identify situations in which they can add value to purchased debt securities by improving recovery rates on distressed assets. The following example illustrates the GP's or fund manager's ability to pursue a strategy to improve recovery rates.

BUSINESS HOTELS AND DEFAULT RISK AFTER THE COVID-19 SHUTDOWN

Following economic shutdowns related to COVID-19, hotel occupancy rates struggled to return to pre-pandemic levels, causing continued distress risk for many hotel owners and their investors. Hotels focused on business and convention traffic were especially risk prone in this environment because of the rise of remote work, which reduced business traveler demand and business meetings that traditionally used hotel conference room space.

Occupancy rates were slow to recover. For example, while Marriott International's occupancy rates exceeded 70% before the COVID-19 pandemic, by 2022, its North American occupancy remained depressed and its international properties remained below 60% occupancy.

Business-focused hotels also faced property value declines as occupancy rates failed to recover, reducing the collateral value of hotel owners and creating debt financing challenges for these issuers, who typically refinance properties every three years. Furthermore, the underlying financing of these hotels consisted largely of floating-rate loans; thus, rising interest costs due to the end of quantitative easing in 2022 placed additional cash flow strains on hotel owners.

While 2023 began with several hotel bankruptcy filings, including the world's tallest Holiday Inn, located in New York City's financial district, other hotel owners bypassed the reorganization process, allowing distressed properties to be foreclosed on by their lenders. Opportunities for asset sales were limited because potential buyers, such as private equity and sovereign wealth funds, were largely waiting for signs of market stabilization before bidding for distressed assets. For example, Blackstone, a significant private equity participant in lodging transactions, did not commit to any hotel purchases in the second half of 2022.

Liquidity Risks

Because a proportion of investors may be forced to sell loans as the underlying assets become distressed, special situations fund GPs actively seek forced sale situations to take advantage of asset mispricing by bidding at prices below what they perceive as fair value.

Legal Risks

The complexity of issues arising from creditor disputes in a distressed environment highlights opportunities for fund GPs who have expertise and experience in navigating the bankruptcy process and negotiating to ensure acceptable recoveries in a distressed environment.

Fund GPs who can successfully manage these risks are more likely to generate significant price appreciation on their investments. Investors should note this difference between the primary source of returns in special situations as compared to private debt in which interest income and return of principal is assumed to be the primary return source. Thus, as a subcategory of private debt in most investor allocations, special situations investment is likely to provide diversification potential relative to private and public debt allocations. This is apparent when we consider the impact of inflation risk and interest rate risk on more traditional debt investments, neither of which is likely to significantly affect special situations returns.

Some private debt funds have a broader investment mandate that allows greater flexibility to pivot between distressed and non-distressed debt investments as industry and economic conditions warrant. This type of mixed focus by private debt funds may be advantageous to those investors with relatively small allocations to private debt and special situations relative to their overall asset allocation. In some cases, a closed-end fund may add an incremental fund to its existing structure to capitalize on a dislocation event, as described in the following example.

CONTINGENT DISLOCATION FUNDS

A contingent dislocation fund (CDF) is designed to invest capital upon the occurrence of a market disruption, or trigger, event. Such events might be defined as a financial or geopolitical crisis or a negative market signal. For private debt funds that typically lend to non-investment-grade companies within their main fund structures, events leading to financial distress offer attractive opportunities when additional capital is available in a timely manner.

Private debt funds often structure CDFs as a supplemental commitment to the primary debt fund, in which investor capital is only drawn if a dislocation event occurs. This provides a flexible mechanism in which the fund can access additional capital in the event of market stress. Typically, the CDF maintains an investment strategy similar to that of the primary debt fund.

The investor due diligence process for special situations fund managers shares common elements with that of a private debt fund manager but has several differences. Both seek to ensure superior credit analysis and structuring skills, as well as a manager's ability to adequately monitor, manage, and periodically value debt obligations. Special situations fund managers must demonstrate additional skills, such as managing legal and procedural aspects of the restructuring, bankruptcy, and liquidation processes important for issuers facing financial distress and dislocation. The following case study addresses a pension plan's evaluation process in considering a special situations fund investment as part of its overall asset allocation.

CASE STUDY

Northern States Evaluates a Special Situations Fund

Northern States Pension Plan is a large US-based public pension plan with extensive private market investment experience. Its investment committee has scheduled a presentation with Bywater Capital on its Special Situations Fund III, the firm's latest fund offering with a strategic focus on distressed debt and other event-driven strategies.

Bywater Special Situations Fund I was recently fully exited with a net IRR of 15.0% and TVPI (total value to paid-in) of 2.0, and Special Situations Fund II is currently on track for similar performance. Compared to other private distressed debt funds, Bywater's performance is in the top quartile. While Bywater has successfully invested in different sectors, its investments recently have been concentrated in hospitality-related industries, including aviation and hotel properties.

Northern States currently owns a diversified public and private market debt portfolio, with a 10% allocation to private debt. Private debt investments include funds invested in senior secured floating-rate, mezzanine, and venture debt, and the underlying securities are typically unrated or below investment grade. The current asset allocation is shown below:

Asset class	Target allocation
Public equity	30%
Private equity	25%
Public fixed income	15%
Private debt	10%
Real estate and infrastructure	15%
Other alternative investments	5%
Total	100%

Northern States' economic outlook has recently changed to incorporate increasing probabilities of financial distress in several global industry sectors. As a result, the investment committee is evaluating investment strategies that may benefit from such an economic environment.

Brianna Jenkins, head of alternative investments at Northern States, has been asked to lead the discussion regarding an investment in Bywater Special Situations Fund III. Jenkins plans a discussion focused on the relation of special situations investing to the larger mandate of private debt investing.

1. Discuss how Northern States' economic outlook may affect the allocation decision to include special situations investments in their private debt portfolio.

   Solution:

   Because Northern States forecasts increasing financial distress in several sectors, the pension plan may be expecting lower returns on a portion of its private debt portfolio as the credit quality of the underlying loan portfolio declines. Distressed opportunities may provide Northern States with opportunities to attempt to partially offset the effects of distress on its existing private debt portfolio. Thus, Northern States may be open to allocating

capital to special situations funds such as Bywater to augment returns in its private debt portfolio over time.

QUESTION SET

1. Discuss how a special situations fund GP creates value for investors with respect to credit risk in distressed debt situations.

   Solution:

   Special situations fund GPs use specialized skills to identify situations in which they can either identify mispricing or add value to purchased debt securities. This involves capitalizing on purchases when existing investors are forced to sell and seeking ways to lower expected losses on their investments below expected losses implied by their purchase prices. Lower expected losses must reflect lower default rates or higher recovery rates in the event of default than expected as part of the restructuring process.

2. Discuss why a pension plan's due diligence process on a distressed debt fund manager should include a thorough review of the fund's ability to address legal risks of potential investments.

   Solution:

   Distressed debt funds generate returns by applying expertise in navigating legal environments associated with debt restructuring and insolvency laws. Thus, a fund's ability to assess legal risks as it considers potential investments will be critical to the ability to add value to the fund. The complexity of issues arising from creditor disputes in a distressed environment highlights opportunities for fund GPs who have expertise and experience in navigating the bankruptcy process and negotiating to ensure acceptable recoveries in a distressed environment.

3. Discuss why a special situations fund may focus on specific industries in its selection of portfolio assets.

   Solution:

   Special situations investors often focus on specific industries due to their more favorable characteristics for distressed investments, including cyclicality and the prevalent use of secured debt to finance fixed assets. For example, firms that face volatile cash flows during economic downturns can represent attractive investment opportunities if their securities are mispriced or certain investors are forced to sell debt or equity. A specialized industry focus is advantageous in understanding asset values in a liquidation scenario. Industries involving firms with complex debt profiles secured by assets, restrictions such as covenants, and other contingencies offer advantages to special situations funds with expertise in understanding the valuation, liquidity, and legal environments that are likely to occur in a specific industry.

PRACTICE PROBLEMS

The following information relates to questions 1-4

Brianna Jenkins, head of alternative investments at Northern States Pension Plan, is working on a presentation to the plan's investment committee to provide fundamental information to help the group consider investing in a distressed debt fund. As part of her work, she develops two visuals showing the contingent payoffs to both debt- and equityholders as functions of the asset value of a company and an equation demonstrating put–call parity.

Jenkins continues her presentation with a numeric example in which she shows a basic example of a structural model of credit risk. A company's asset value is CAD800 million, and it has zero-coupon debt with face value of CAD1,000 million maturing in two years. The volatility of the company's assets is 20% per year. The risk-free rate is 5% per year. Jenkins shows output from this model indicating that the value of a call option on this company's assets with an exercise price of CAD1,000 million is equal to CAD52 million and then states that the company's debt is trading at an observed credit spread of 10.4%.

Jenkins includes some examples of differing circumstances that may cause a company's debt to become distressed. Her examples include recessions, innovations that disrupt specific industries, and instances of company mismanagement and fraud. Jenkins follows this material with some discussion of additional operating risks faced by issuers in distress, such as loss of customers and employees.

Jenkins looks to close her presentation by providing some discussion of opportunities to invest in distressed debt funds. Northern States recently received a proposal from Bywater Partners to consider investing in its Bywater Special Situations Fund III. Bywater Partners has decided to focus exclusively on special situations investing. Alternatively, Northern States has an existing relationship with Spleenwood Capital, a firm with a broad private debt strategy. Spleenwood has begun including contingent dislocation funds (CDFs) as part of its private debt funds.

1. Which of the following best describes what Jenkins is seeking to illustrate with her visuals and the put–call parity equation?

   A. Equity value is zero any time that company asset value declines below face value of debt.

   B. Debt value is independent of equity value.

   C. Debt and equity values may be characterized as option values based on company asset value.

2. Analyze whether there is a profitable capital structure arbitrage trade available based on Jenkins's example.

3. Discuss the potential for a distressed issuer to suffer from excessive loss of employees depending on whether distress is more related to industry-specific conditions than company mismanagement.

4. Discuss one fundamental difference with respect to a distressed debt allocation

between committing capital to Bywater versus Spleenwood.

The following information relates to questions 5-8

Spleenwood Capital, a private market firm focused on debt-focused investment strategies, is exploring the possibility of starting an event-driven special situations fund. The firm desires to focus primarily on debt-oriented control strategies but is open to considering other types of event-driven strategies. Given Spleenwood's desire to specialize in taking controlling stakes, the firm's principals believe that other investment strategies focused on assessing business combinations, such as merger arbitrage, may fit well with the overall fund focus.

Spleenwood explores additional approaches to merger arbitrage strategies that may leverage their skills in buying corporate debt. Specifically, Spleenwood considers investing in the debt of target companies with associated change-of-control clauses.

Spleenwood's managing directors further discuss a strategy of investing in debt of companies in which perceptions of mismanagement have contributed to long-term solvency issues. Spleenwood believes that there are profitable opportunities to pursue active and controlling strategies in buying company debt in such an environment.

Spleenwood prefers to avoid situations in which portfolio companies need to enter Chapter 11 bankruptcy reorganization in the United States as part of its active, controlling strategy. Rather, it prefers to buy the debt of companies that can be restructured outside the court system. However, if Chapter 11 cannot be avoided, Spleenwood strives to negotiate for prepackaged bankruptcy filings.

5. Contrast the event risk associated with merger arbitrage strategies with the event risk typically associated with distressed debt investing.

6. Discuss how Spleenwood expects to profit from a strategy targeting companies with change of control clauses.

7. Discuss why Spleenwood may prefer to negotiate debt-for-equity exchanges as a financing strategy (compared to other possible strategies) for its portfolio holdings in which mismanagement perceptions exist, and explain a potential challenge to implementing the strategy.

8. Discuss one significant reason why Spleenwood prefers to avoid unplanned Chapter 11 bankruptcy filings for the companies in which it has invested in debt, and discuss briefly what must happen to avoid this outcome.

The following information relates to questions 9-12

Laborantibus Partners, a private market firm specializing in distressed debt, is considering investments in public securities issued by Fracassar PLC, a British hotel chain encountering financial difficulties. Fracassar's debt, maturing in six months, is currently trading at GBP6,000 million. While Laborantibus has valued Fracassar as a going concern using a relative valuation approach based on public-

ly traded European hotel chain comparables at an enterprise value of GBP9,000 million, it estimates a 30% probability that Fracassar defaults on its GBP7,500 million of debt in six months. Laborantibus assesses the liquidation value of Fracassar's assets at GBP3,000 million. Assume that the risk-free rate is 5% annually.

A few members of the Laborantibus investment committee express reservations about estimating Fracassar's enterprise value as a going concern using a relative valuation approach. They suggest that an income-based approach may be superior to use as a going concern valuation approach.

Laborantibus examines opportunities to trade across different seniorities of Fracassar's debt instruments. Fracassar's debt consists of GBP4,500 million of senior secured debt and GBP3,000 million of junior second-lien debt. The senior debt is trading at GBP4,200 million, and the junior debt is trading at GBP1,800 million.

Laborantibus observes that the credit default swap spreads on Fracassar's debt are higher than the associated bond spreads. Laborantibus considers the potential for a profitable trading opportunity.

9. Recommend whether Laborantibus should pursue an investment in Fracassar debt.

10. Evaluate the choice of estimating Fracassar's going concern value using relative valuation versus using an income-based approach.

11. Recommend a capital structure arbitrage trade involving Fracassar's senior and junior debt.

12. Explain how Laborantibus can create a synthetic Fracassar bond using a CDS.

SOLUTIONS

1. C is the correct response. Asset value may be written as $V_0 = c_0 + \text{PV}(D) - p_0$. The equation reflects put–call parity, and the shareholder payoff is shown as a call option on firm value (c_0), while the debtholder payoff is equal to risk-free debt, PV(D), and the sold put ($-p_0$). A is incorrect because equity value will often be greater than zero despite asset value falling below face value of debt because of the call option's time value. B is incorrect because the debt value and equity value are related as a result of put–call parity.

2. Given that the equity value of the company is equal to the call option value of CAD52 million, the company's debt value is equal to CAD748 million (= CAD800 million – CAD52 million). The company's implied credit spread is approximately 9.5% {= [(1/2) × ln(1,000/748)] – 0.05}. Because the observed credit spread is approximately 90 bps greater, a profitable capital structure arbitrage is to buy the company's debt and sell its equity.

3. An operating risk, such as loss of employees, may depend on whether the events leading to the distress are macroeconomic, industry specific, or company specific.

   Distress due to macroeconomic factors typically involves economic downturns leading to poor operating and financial performance.

   In the case of distress due to industry-specific causes (such as the distress that occurred during and following the COVID-19 pandemic in travel-related industries), employees may find limited job opportunities that align with their experience and training.

   In the case of distress due to a company-specific factor related to mismanagement of a company, employees are more likely to have the ability to find alternate job opportunities related to their experience and training.

4. By committing capital to Bywater, Northern States is making an explicit allocation to distressed debt. In contrast, a commitment to Spleenwood commits capital to a distressed debt allocation only if a dislocation event occurs.

5. A merger arbitrage strategy's returns are defined by whether an acquisition is completed. For distressed debt investing, the event is resolution of distress. Unlike the merger arbitrage investment, resolution of distress is not a simple "yes" or "no" solution. The resolution of distress may take many forms of outcome in terms of how a distressed company's assets are divided between claimants. As such, the event risk for distressed debt is more complicated compared to that of merger arbitrage.

6. A change-of control-clause included in a corporation's covenants requires the issuer to offer to repurchase outstanding bonds at a fixed price at or above par, conditional on a new owner acquiring a specified percentage of the issuer's voting shares. Thus, Spleenwood will identify issuers with change-of-control clauses on their bonds that are potential takeover targets. By buying the debt of the most likely takeover targets, Spleenwood expects to sell back purchased bonds at a profit once the change-of-control clause is triggered.

7. A perception of mismanagement may provide incentives for Spleenwood to convert debt holdings into equity stakes sufficiently large to force a change in management. Other approaches to financing a distressed firm cannot address the issue of poor management because none of the other strategies translate into

company ownership. The primary challenge for Spleenwood will be to buy a sufficiently large stake of company debt to ensure enough governance power after the debt-for-equity exchange to enact a management change.

8. An unplanned Chapter 11 bankruptcy filing is unlikely to be resolved quickly. A typical time frame for the company to successfully reorganize in this setting is likely to be two to three years or more, and this would reflect Spleenwood's investment horizon as an active, controlling investor. Avoidance of the unplanned Chapter 11 bankruptcy requires agreement among all creditors. For example, a prepackaged bankruptcy requires two-thirds of the volume and one-half of claimants to agree to terms, while out-of-court restructurings require all creditors to agree.

9. Based on the data given, Laborantibus would estimate that Fracassar's enterprise value is GBP7,200 million, as shown below.

   Enterprise value in six months = $0.3 \times 3{,}000 + 0.7 \times 9{,}000$ = GBP7,200.

   If Laborantibus buys all of Fracassar's debt, the expected value is GBP6,150 million, as shown below.

   Debt value in six months = $0.3 \times 3{,}000 + 0.7 \times 7{,}500$ = GBP6,150 million.

   Implied return for six months = $(6{,}150 \div 6{,}000) - 1 = 2.5\%$.

   Laborantibus should not pursue an investment in Fracassar debt at its current price of GBP6,000 million. The expected return is approximately equivalent to the risk-free rate of 5% annually (i.e., 2.5% over half a year), which provides no compensation for the risks involved.

10. While both valuation approaches are more difficult to use for distressed companies, an approach using non-distressed comparables may be appropriate for assessing a going concern terminal value at the future date when the company either defaults or does not default. An income-based approach to valuation typically assumes several years of cash flows discounted at a risk-adjusted cost of capital. This approach likely creates several estimation challenges associated with both the cash flows (i.e., numerator issues) and the discount rate (i.e., denominator issues). Overall, the use of relative valuation is likely to be a less challenging approach to implement in valuing Fracassar as a going concern.

11. Using the default probability of 30% and the seniority structure of the two classes of debt, we estimate the value of the senior and junior debt in six months as follows:

    Senior debt value in six months = $0.3 \times 3{,}000 + 0.7 \times 4{,}500$ = GBP4,050 million.

    Junior debt value in six months = $0.3 \times 0 + 0.7 \times 3{,}000$ = GBP2,100 million.

    The future value of senior debt of GBP4,050 million is below its trading price of GBP4,200 million. Thus, the senior debt is clearly overpriced. The value of the junior debt implies a return of 16.67% over six months [= $(2{,}100 \div 1{,}800) - 1$]. Thus, a capital structure arbitrage would be to buy Fracassar junior debt and sell short its senior debt.

12. Laborantibus may create a synthetic long bond position in Fracassar by depositing the desired amount of the bond purchase at the market reference rate, selling CDS protection to collect the "high" CDS spread on Fracassar, and entering a receive-fixed interest rate swap to protect against interest rate risk from volatility in the MRR. The resulting return stream is the locked-in MRR plus the CDS spread received.

LEARNING MODULE

6

Private Real Estate Investments

LEARNING OUTCOMES

Mastery	*The candidate should be able to:*
☐	discuss important private real estate investment features
☐	discuss economic value drivers of private real estate investments and their role in a portfolio
☐	discuss the due diligence and valuation processes for private real estate
☐	discuss the distinctive investment characteristics of timberland and farmland
☐	discuss the risk and return among private real estate investments and as compared to other investments as part of a strategic asset allocation

INTRODUCTION

1

Real estate investments are heterogeneous building and property assets in illiquid and fragmented local markets. While earlier learning modules addressed income-producing properties and publicly traded real estate, such as real estate investment trusts (REITs), we now turn our attention to private real estate investments. While this asset class spans a wide range of investments, including diversified and core funds, we focus here on the features, economic drivers, valuation, and portfolio characteristics of value-add and opportunistic real estate investments. According to the alternative investment data provider Preqin, private real estate is the third-largest private markets asset class, of which roughly one-third involves value-add investments, one-third is opportunistic, and the remaining third involves privately held core or other assets. Private real estate is expected to exceed USD2 trillion in assets under management (AUM) by 2027 globally, over half of which is expected to be in North America, despite rapid growth in Asia and Europe. Private real estate equity and debt investments typically exhibit more equity-like return characteristics. They often involve major property renovation, repositioning, or new construction. In contrast, raw and less developed land used in agriculture and forestry represents distinct segments of the private real estate market.

In this learning module, we first distinguish key features of private real estate markets. These investments often occur over a property development life cycle, unlike the more stable, consistent cash flows associated with core real estate. Farmland and timberland, in contrast, involve fewer or no physical improvements and derive their

economic value from current and future agricultural use or the timber growth cycle, as well as capital appreciation. These differences give rise to specific investment characteristics for private real estate debt and equity investors, unique due diligence and valuation challenges, and distinctive risk and return features that define the role of these investments in a strategic asset allocation.

LEARNING MODULE OVERVIEW

- Private real estate investments usually involve major property refurbishment, repositioning, or new development and exhibit more equity-like characteristics than income-producing property.
- Debt and equity instruments used in property development frequently differ from public real estate investments in terms of the timing, terms, and type of funding involved, which often vary over capital commitment, deployment, and distribution phases.
- Private real estate due diligence incorporates more complex private investment structure details and the capital and development life cycles, while valuation approaches often include scenario and sensitivity analysis in addition to income and sales comparison approaches.
- Timberland and farmland are unique forms of largely private real estate investment involving raw land whose value is derived from economic use associated with the timber growth cycle or agricultural use, as well as potential capital appreciation.
- Relative risk and return analysis of private real estate investments assesses the expected timing and volatility of expected income and price appreciation based on economic drivers and includes the complex compensation structures of these investments.

2 PRIVATE REAL ESTATE INVESTMENT FEATURES

☐ | discuss important private real estate investment features

General Characteristics

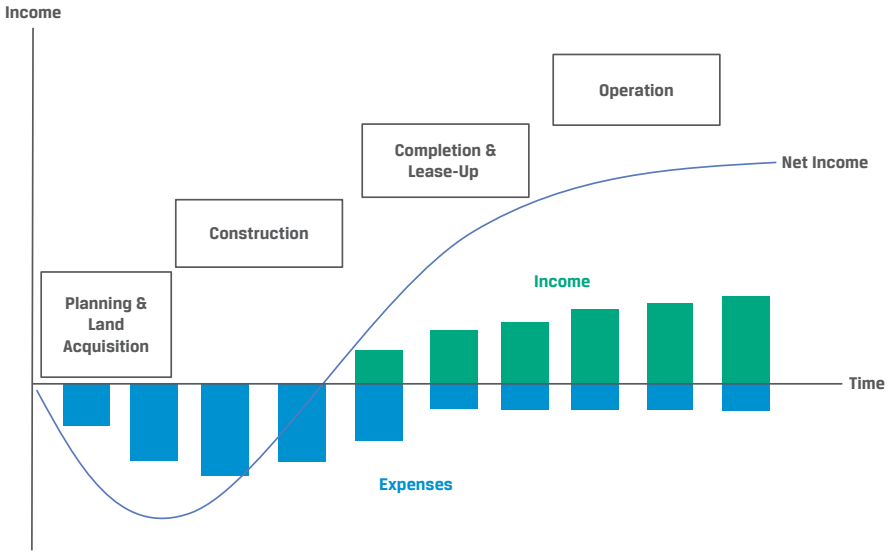
Real estate investments span a broad spectrum, from portfolios of stable income-producing equity or debt property assets, such as publicly traded REITs or mortgage-backed securities, which are publicly traded, to private investments. These private investments may involve anything from repurposing, repositioning, or developing new properties to using raw or undeveloped land for agriculture or forestry. In this lesson, we will concentrate on private debt and equity investments, particularly those that fall in the upper right area of Exhibit 1.

Exhibit 1: Real Estate Investment Characteristics

New property developments, particularly those requiring substantial improvement as part of opportunistic real estate strategies, entail higher risk. They also exhibit more equity-like return characteristics. Such investments are commonly undertaken through private real estate vehicles, such as limited partnerships. As in the case of other private markets, private real estate investments typically involve longer investment periods, reduced liquidity, and greater direct control due to the transformational nature of value-add and opportunistic investment. Private real estate funds are different from **open-end funds** in public markets, which allow investors to contribute or withdraw capital freely and have no predetermined end date. Private real estate funds can be either open-end funds with certain constraints, known as **interval funds**, or **closed-end funds**. Interval funds lack a predetermined maturity date but come with liquidity constraints, such as limits on the proportion of total assets that can be redeemed periodically. Closed-end funds, in contrast, have a finite lifespan, necessitating an upfront capital commitment, a lockup period, and the eventual sale of the property or properties to distribute returns to investors.

In the realm of closed-end funds, general partners (GPs) typically combine several properties into a real estate limited partnership or a limited liability company, which is then distributed to numerous limited partners (LPs). Alternatively, GPs might establish separately managed accounts that consist of bespoke investments tailored for specific investors. One distinguishing characteristic of newly developed properties is the distinct phases they undergo in the real estate development life cycle, as demonstrated in Exhibit 2.

Exhibit 2: Property Development Life Cycle



Although details of the development cycle vary for each property, there are five universal phases: planning, land acquisition, construction, completion and lease-up, and operation.

Planning

Developers constructing buildings on undeveloped or reclaimed land must first establish the physical and economic feasibility of a project. The initial step in the planning process is to assess a project's physical feasibility, or one that represents the site's best economic use, in compliance with local laws and regulations. For example, zoning requirements often restrict economic use and require provisions for **setback** or distance to property lines and **circulation**, such as security and emergency access to buildings or facilities. Consider the following case study, the first of several throughout this learning module that discuss the Pandan East project.

CASE STUDY

Pandan East Feasibility Study

A private real estate investor is assessing the physical feasibility of a vacant three-acre (130,680 ft^2) site for a 1,200-unit residential facility outside Kuala Lumpur, Malaysia, along the proposed Mass Rapid Transit Circle Line. Local zoning requirements dictate that 20% of the land must be set aside for setback and circulation, with the following apartment and parking plans:

- Apartments—Three 20-story towers with one 0.5-acre courtyard between the three towers,and each floor with an average of 20 units (1,200 ft^2 each) and 2,500 ft^2 of common space
- Parking—1,000 ft^2 per tower for surface parking, with additional space underground

1. Assess the Pandan East project site feasibility given zoning restrictions, the site plan, and building and parking requirements.

   Solution:

   Zoning restrictions include setback and circulation of 26,136 ft^2 (= 0.2 × 130,680) and an open courtyard of 21,780 ft^2 [= 130,680 × (0.5/3)], while parking requirements total 3,000 ft^2 (= 1,000 × 3) and the building footprint is 79,500 ft^2 {= 3 × [(20 × 1,200) + 2,500]}. Solve for 264 ft^2 in excess space:

Physical Feasibility	ft^2
Gross Land Area	130,680
Less: Setback and Circulation	(26,136)
Less: Open Area	(21,780)
Available to Develop	82,764
Parking Space Needs	(3,000)
Available to Build	79,764
Building Footprint	(79,500)
Excess Space	264

Economic feasibility involves weighing a property's future economic use by residential or commercial tenants versus construction and operating costs to determine whether the project will meet or exceed required rates of return for debt and equity investors upon completion. Recall from earlier real estate learning modules that **net operating income** (NOI) is a key property income measure that ignores financing costs and taxes, as shown in Equation 1:

NOI = Effective gross income – Operating expenses – Property maintenance allowance. (1)

We may estimate initial project return to both debtholders and equityholders on the basis of NOI versus project cost as follows:

Project return = NOI/Project cost. (2)

Consider Pandan East's expected NOI and project return upon completion based on cost and rental assumptions in the following case study.

CASE STUDY

Pandan East Expected NOI and Project Return

The Pandan East project plan includes 1,200 residential units averaging 1,200 ft^2 each. Project planners estimate a monthly rent per ft^2 net of expenses in Malaysian ringgit of MYR2.75, with no additional income. Occupancy is expected to be 95% upon completion in two years, with 30% of gross rent as expenses, including a small capital improvement allowance. Estimated costs are as follows:

Line Item	MYR
Land	25,000,000
On-site land improvements	10,000,000
Construction cost/unit	200,000

1. Calculate Pandan East's expected NOI upon completion.

   Solution:

   Calculate NOI using Equation 1. First, solve for effective gross income as equal to gross rent, or revenue from rental of the 1,200 units at full occupancy:

   $$\text{Gross rent} = \text{MYR}47{,}520{,}000 = 1{,}200\text{ft}^2 \times 1{,}200 \text{ units} \times 2.75 \text{ rent/ft}^2 \times 12.$$

   Next, subtract vacancies and operating expenses (5%, or 100% – 95%, and 30% of gross rent, respectively) from gross rent:

   $$\text{NOI} = \text{MYR}30{,}888{,}000 = (1 - 0.35) \times \text{MYR}47{,}520{,}000.$$

2. Calculate Pandan East's project cost and return based on NOI.

   Solution:

   Calculate project costs by adding construction costs of MYR240,000,000 (= 1,200 units × MYR200,000/unit) to other costs:

Line Item	MYR
Land	25,000,000
On-site land improvements	10,000,000
Construction cost	240,000,000
Project cost	275,000,000

   The return is equal to the NOI from Question 1 divided by project cost:

   $$\text{Rate of return} = 11.23\% = \frac{\text{MYR } 30,888,000}{\text{MYR } 275,000,000}.$$

Recall from prior learning modules that the required rate of return on a property is often referred to as the **capitalization rate**, or cap rate. The **direct capitalization approach** shown earlier in the curriculum divides a single year's net operating income by the cap rate to estimate a property's value:

$$\text{Property value} = \frac{\text{Expected NOI}}{\text{Capitalization rate}}. \tag{3}$$

Land Acquisition

A developer may acquire land using a combination of equity and debt secured by the property. In addition to ensuring a property is free of outstanding liens or tax obligations, the acquiror must also receive approval for project plans and obtain necessary building permits and zoning exemptions or amendments prior to initiating construction. A prospective buyer may enter into an option agreement to secure the right, but not the obligation, to purchase a property at a fixed price for the period over which these issues are addressed. Investors may also choose to buy and operate an existing property with the intention of renovating in the future, as shown in a later case study.

Construction

The land improvement and building phase involves far greater execution risk than property operation. Potential delays and disruptions include labor disputes, unanticipated slowdowns in the supply of materials or equipment, and adverse weather conditions. Also, changing market prices can drive cost overruns for building materials, as in the following example.

LUMBER PRICES DURING THE COVID-19 PANDEMIC

Lumber is an important commodity in US single-home residential construction, representing around 15%–20% of construction costs. Lumber price volatility increased during the COVID-19 pandemic. Exhibit 3 shows front-month lumber futures prices for a three-year period starting in March 2020.

Exhibit 3: Front-Month US Lumber Futures Prices, March 2020–March 2023

Source: Bloomberg.

As the pandemic began, lumber prices were close to USD400 per 1,000 board feet (1,000 board feet equals 2.36 m^3), surging until early May 2021, when the lumber futures price peaked at USD1,686, over four times the level from a year earlier. Note that the lumber futures contract specification has subsequently been amended to one-quarter of the original size, or roughly the amount of lumber used to build an average house in the United States.

While demand increased due to the impact of rising home prices on new construction starts and renovations, supply disruptions related to COVID-19 included labor shortages and decreased mill capacity due to health protocols. While lumber prices fell by late summer of 2021, another sharp price increase in the fall of 2021 coincided with a subsequent surge in COVID-19 cases, peaking in late winter before gradually declining, as Federal Reserve interest rate hikes dampened housing demand and lumber prices fell back to levels closer to historical averages.

In addition to changing market dynamics affecting project costs, construction delays pose risks for future income assumptions as market conditions change. Also, if a project encounters problems that require it to be sold during the construction phase, the sale price may be below total project costs incurred.

Completion and Lease-Up

Project risks continue to rise as a development nears completion given the need to offset rising costs with expected rental income. While some projects involve space built for a specific tenant, in the case of multiple commercial or residential tenants, developers often seek to pre-lease undeveloped or unfinished space using such incentives as reduced or free rent and free amenities for a given period in exchange for lease commitments.

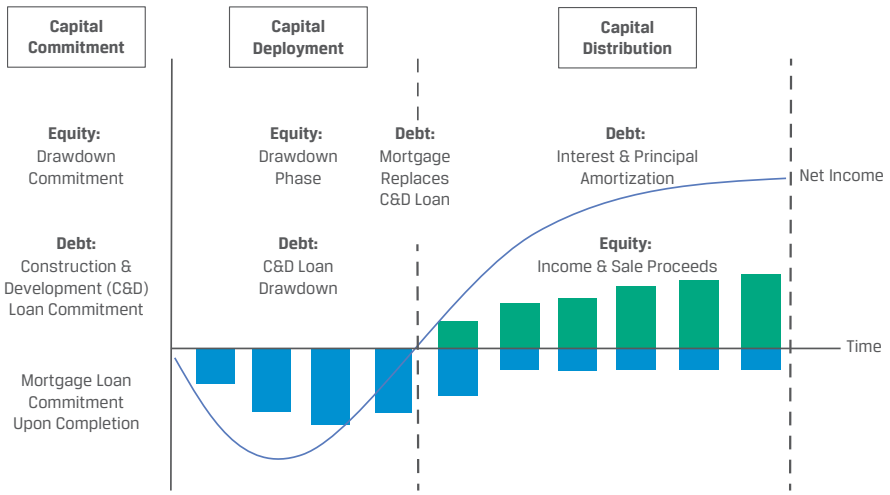
Operation

Once the initial lease phase is complete, property risk declines, because longer-term tenant commitments are in place, and the property management phase begins. While public investment vehicles, such as REITs, often buy and hold such income-producing

properties once normal occupancy is reached, private investors may play different roles over the life cycle, from developing a property on a speculative basis to be sold upon completion to selling a fully leased property on an opportunistic basis or owning and operating it indefinitely.

The features of private real estate debt and equity investments differ from those of public investments, usually consisting of income-producing properties, in several important ways. The first is timing, as debt and equity capital needs for new development rise from the time of site purchase through the construction period and completion phase. Second, the type of funding often varies over phases of the development cycle. For example, an **acquisition and development loan** (ADL) may be used to purchase and prepare land for a specific construction use, while a **construction and development loan** is outstanding during the building phase. ADLs and construction and development (C&D) loans disbursed over time typically accrue interest over the period of negative cash flow and are later replaced by a long-term mortgage loan. Equity also may be drawn down over time as a project meets certain milestones. Private real estate investments often follow capital commitment, deployment, and distribution phases over the development cycle, similar to many other alternative and private investments, as shown in Exhibit 4.

Exhibit 4: Sample Real Estate Development Financing Plan



Earlier real estate learning modules addressed measures used by debt and equity investors to assess risk and return. For example, debt investors use leverage and coverage measures to evaluate creditworthiness, including the **loan-to-value ratio** (LTV) and **debt service coverage ratio** (DSC), respectively:

$$\text{LTV} = \frac{\text{Debt outstanding}}{\text{Current property value}}. \tag{4}$$

$$\text{DSC} = \frac{\text{Net operating income}}{\text{Debt service}}. \tag{5}$$

A lower LTV and a higher DSC indicate greater creditworthiness. For example, while levels vary, real estate lenders often target an LTV of 0.8 or lower, whereas a DSC of 2× or greater is generally considered strong, with a minimum target of 1.2× to 1.4×. Equity investors, in contrast, evaluate before-tax returns using actual or expected NOI less debt service using an **equity dividend rate**:

$$\text{Equity dividend rate} = \frac{\text{Before-tax cash flow}}{\text{Property purchase price} - \text{Debt outstanding'}} \quad (6)$$

where

$$\text{Before-tax cash flow} = \text{NOI} - \text{Debt service.} \quad (7)$$

We now examine the Pandan East project financing plan using these metrics.

CASE STUDY

Pandan East Financing Plan Details

Pandan East's MYR275,000,000 project financing plan is as follows:

Equity: 25% of cost, or MYR68,750,000 drawn in three steps. GP performance fees equal 20% of returns above a 15% hurdle rate upon completion.

1. Equity drawdown
   - Initial: MYR25,000,000 (land purchase and fees)
   - One Year: MYR25,000,000
   - Two Years: MYR18,750,000

Debt: 75% of cost, or MYR206,250,000 from private investors in two forms:

1. Construction and development loan
   - 10% annual interest
   - Monthly disbursements linked to construction milestones, such as zoning approval, foundation completion, and property inspections
   - Interest accrues monthly over a two-year construction period.
   - Loan is to be repaid from mortgage loan proceeds.
   - Secured by Pandan East land, property, and other project assets
   - End-of-month drawdowns as follows:
     - Month 1: MYR15,000,000
     - Months 2–6: MYR10,000,000
     - Months 7–20: MYR7,500,000
     - Months 21–23: MYR5,000,000
     - Month 24: MYR200,635
2. Mortgage loan
   - 20-year, MYR206,250,000 amortizing loan starting in two years
   - Drawn after final inspection and once construction claims and wages are paid and no property liens exist
   - 7% annual interest rate with fixed monthly payments of interest and principal repayment
   - Secured by Pandan East land and property

1. Calculate and show the ratio of equity to total capital monthly for the first year of the Pandan East project.

   Solution:

   Equity drawdown of MYR25,000,000 occurs both at inception and in one year's time, while C&D debt outstanding at month end is the sum of the loan drawdown to date and interest accrued on the initial period balance at the

monthly equivalent of a 10% annual rate. Recall from earlier time-value-of-money lessons that this may be converted to a monthly rate, as follows:

$$R_{annual} = \left(1 + R_{monthly}\right)^{12} - 1;$$

$$R_{monthly} = 0.7974\% = (1 + 0.10)^{1/12} - 1.$$

Therefore, at the end of Month 2, the outstanding C&D loan balance is equal to MYR25,119,612, calculated as follows:

- MYR15,000,000 drawn at the end of Month 1
- MYR119,612 interest on initial balance (= 0.79741% × 15,000,000)
- MYR10,000,000 drawn at the end of Month 2

MYR25,119,612 = 15,000,000 + 119,612 + 10,000,000.

Use a spreadsheet to calculate monthly debt and equity balances. The following table provides a summary for the first 12 months. Candidates should note that the numbers presented throughout this case study as well as later case studies may reflect rounding from the spreadsheet calculations.

Month	C&D Loan Drawdown	C&D Interest	C&D Loan Balance	Equity	Total	Equity/ (Debt + Equity)
1	15,000,000	0	15,000,000	25,000,000	40,000,000	0.63
2	10,000,000	119,612	25,119,612	25,000,000	50,119,612	0.50
3	10,000,000	200,307	35,319,919	25,000,000	60,319,919	0.41
4	10,000,000	281,646	45,601,565	25,000,000	70,601,565	0.35
5	10,000,000	363,633	55,965,199	25,000,000	80,965,199	0.31
6	10,000,000	446,274	66,411,473	25,000,000	91,411,473	0.27
7	7,500,000	529,574	74,441,047	25,000,000	99,441,047	0.25
8	7,500,000	593,603	82,534,651	25,000,000	107,534,651	0.23
9	7,500,000	658,143	90,692,794	25,000,000	115,692,794	0.22
10	7,500,000	723,197	98,915,991	25,000,000	123,915,991	0.20
11	7,500,000	788,770	107,204,761	25,000,000	132,204,761	0.19
12	7,500,000	854,866	115,559,627	50,000,000	165,559,627	0.30

2. Solve for the LTV at the end of 12 months if the project's value equals cost in terms of debt and equity, as well as the DSC for the first year upon completion using Pandan East's expected NOI from the previous case study.

Solution:

Use Equation 4 to solve for LTV at the end of 12 months as follows:

$$\text{LTV} = 0.70 = \frac{115,559,627}{165,559,627}.$$

Note that LTV equals 1 – Equity/(Debt + Equity) in the solution to Question 1.

To determine DSC upon completion, we must solve for the fixed monthly mortgage loan payment. Earlier fixed-income lessons showed that periodic payments (A) for a fully amortizing loan using an annual rate can be calculated as follows:

$$A = \frac{r \times \text{Principal}}{1-(1+r)^{-n}},$$

where

A = Periodic payment

r = Interest rate per period (0.005833 = 0.07/12)

Principal = Principal amount (MYR206,250,000)

n = Number of periods (240 = 20 × 12)

Solve for A of MYR1,599,054 per month as follows:

$$A = \text{MYR}1,599,054 = \frac{0.005833 \times \text{MYR}206,250,000}{1-(1+0.005833)^{-240}}.$$

We may also derive A using the Excel PMT function, PMT(*rate*,*nper*,*pv*,[*fv*],[*type*]), and solving for MYR1,599,054 using PMT(0.005833,240,206250000,0,0). The final entry of zero indicates that the mortgage loan settles at the end of the period.

Annual mortgage debt service is therefore MYR19,188,649 (= 1,599,054 × 12). Solve for DSC to be 1.61 using Equation 4 and NOI of MYR30,888,000 from Question 1 in the previous case study as follows:

$$\text{DSC} = \frac{\text{Net operating income}}{\text{Debt service}}.$$

$$\text{DSC} = 1.61 = \frac{\text{MYR}30,888,000}{\text{MYR}19,188,649}.$$

3. Calculate the equity dividend rate upon completion using Pandan East's expected NOI from the previous case study, as well as the GP performance fee.

Solution:

Using Pandan East's annual debt service of MYR19,188,649 from Question 2, solve for before-tax cash flow of MYR11,699,351 using Equation 6:

Before-tax cash flow = NOI – Debt service = 30,888,000 – 19,188,649.

Use Equation 6 to solve for the equity dividend rate:

$$\text{Equity dividend rate} = \frac{\text{Before-tax cash flow}}{\text{Property purchase price} - \text{Debt outstanding}}.$$

$$17.02\% = \frac{\text{MYR}11,699,351}{\text{MYR}275,000,000 - \text{MYR}206,250,000}.$$

GP performance fees are equal to 20% of the equity dividend rate in excess of the 15% hurdle rate. We first determine the before-tax cash flow threshold by multiplying the denominator of Equation 6 (MYR68,750,000 = 275,000,000 – 206,250,000) by the hurdle rate:

MYR10,312,500 = MYR68,750,000 × 0.15.

Next, we subtract this from the actual before-tax cash flow:

GP performance fee = MYR277,370 = 0.20 × (11,699,351 – 10,312,500).

The Pandan East financing plan illustrates the timing and sources of funding for real estate development projects, as well as their relative risk and return. Despite its shorter tenor and use of the same underlying project as security, C&D lenders expect to earn a higher interest rate than mortgage lenders due to the greater default risk over the construction and development phase. Potential delays and disruptions and changing market conditions involve far greater execution risk than managing an existing income-producing property. A forced sale prior to completion may result in a price well below total project costs incurred. These loans often involve non-standard terms and may be more speculative in nature if no upfront mortgage commitment is in place. While C&D loan repayment depends on timely project completion and the disbursement of more permanent mortgage financing, positive rental cash flows upon project completion are a more reliable primary source of debt repayment. Equity returns also rely on future project income and a property's future sale price, which, as we will see in the following lesson, depends on key value drivers and economic conditions.

QUESTION SET

Questions 1–3 are based on the following information.

Asiastruct, a private real estate fund based in Singapore, has identified a property outside Bangkok for a residential development similar to the previous Pandan East case studies. The following information provides a summary of expected financial information on the property, development costs, and financing, shown in Thai bhat (THB):

Property:

- 900 residential units averaging 1,400 ft^2 each
- THB0.65 monthly rent/ft^2 at 95% occupancy expected in two years
- Operating expenses (including improvements) = 33% of gross rent.

Cost:

- Expected construction costs per unit = THB50,000.
- Expected land cost = THB6,000,000.
- Cost of land improvements = THB3,000,000.

Financing:

- Equity: THB12,750,000 with THB5,000,000 drawn in both Months 1 and 12 and THB2,750,000 drawn in Month 24
- Debt: THB41,250,000
  - Two-year C&D loan at 10% annual interest accrued monthly
    - Drawdowns
      - Month 1: THB3,000,000
      - Months 2–6: THB2,000,000
      - Months 7–20: THB1,450,000
      - Months 21–23: THB1,000,000
      - Month 24: THB801,398
  - 20-year mortgage loan drawn to repay C&D loan:
    - 6.80% annual interest with fixed monthly payments
    - Fully amortizing loan starting in two years

1. Contrast the NOI and rate of return on the Bangkok opportunity to those from the Pandan East opportunity.

   Solution:

   To calculate NOI, first calculate annual gross rent of THB9,828,000 by multiplying the number of units (900) by average size per unit (1,400 ft^2) by expected monthly rent (0.65) by 12 months:

   Annual gross rent: 9,828,000 = 900 × 1,400 × 0.65 × 12.

   To solve for NOI, deduct vacancy costs equal to 5% of annual gross rent (or THB491,400) and deduct operating costs equal to 33% of annual gross rent (or THB3,243,240) to solve for NOI of THB6,093,360.

   NOI: THB6,093,360 = 9,828,000 × (1 – 0.05 – 0.33).

   Use Equation 2 to solve for the project's rate of return:

   Project return = NOI/Project cost.

   Total project cost is equal to the sum of land costs, land improvements, and expected construction costs of THB45,000,000 derived by multiplying the THB50,000 per unit by 900 units:

   THB54,000,000 = THB6,000,000 + THB3,000,000 + THB45,000,000.

   Divide NOI of THB6,093,360 by total project cost of THB54,000,000 to solve for a project return equal to 11.28%.

   Project return: 11.28% = (6,093,360/54,000,000)

   The NOI and project returns for the Bangkok and Pandan East projects are as follows:

Measure/Project	Bangkok	Pandan East
NOI	THB6,093,360	MYR30,888,000
Project Return	11.28%	11.23%

   While the NOIs reflect differences in currency values, the expected project rates of return expected on these two projects are nearly the same.

2. Use the following table derived from the C&D loan to solve for the Bangkok project's LTV ratio at the end of Month 12 of the project.

   Monthly Interest: 0.79741%

Month	Project Costs	Interest	Loan Draws	Loan Balance	Equity	Total	Equity/ Value	LTV
1	3,000,000	0	3,000,000	3,000,000	5,000,000	8,000,000	0.63	0.37
2	2,000,000	23,922	3,023,922	5,023,922	5,000,000	10,023,922	0.50	0.50
3	2,000,000	40,061	5,063,984	7,063,984	5,000,000	12,063,984	0.41	0.59
4	2,000,000	56,329	7,120,313	9,120,313	5,000,000	14,120,313	0.35	0.65
5	2,000,000	72,727	9,193,040	11,193,040	5,000,000	16,193,040	0.31	0.69
6	2,000,000	89,255	11,282,295	13,282,295	5,000,000	18,282,295	0.27	0.73
7	1,450,000	105,915	13,388,209	14,838,209	5,000,000	19,838,209	0.25	0.75
8	1,450,000	118,322	14,956,531	16,406,531	5,000,000	21,406,531	0.23	0.77
9	1,450,000	130,828	16,537,359	17,987,359	5,000,000	22,987,359	0.22	0.78

Month	Project Costs	Interest	Loan Draws	Loan Balance	Equity	Total	Equity/ Value	LTV
10	1,450,000	143,434	18,130,793	19,580,793	5,000,000	24,580,793	0.20	0.80
11	1,450,000	156,140	19,736,933	21,186,933	5,000,000	26,186,933	0.19	0.81

Solution:

To compute the project LTV ratio for the following month, use project assumptions or calculations to compile the data in the columns from left to right for Month 12 as follows:

- Project Cost (Month 12): THB1,450,000
- Construction Interest: THB168,948 (or 0.797414% × THB21,186,933, equal to the Month 11 loan balance)
- Loan Draws: THB 21,355,881 (Month 11 loan balance of THB21,186,933 + THB168,948 in Month 12 construction interest)
- Loan Balance: THB22,805,881 (total draws of THB21,355,881 + THB1,450,000, Month 12 project cost)
- Equity Drawdown: THB5,000,000 (Month 12 equity drawdown as assumed)
- Total Equity: THB10,000,000 (existing equity of THB5,000,000 + THB5,000,000 equity drawdown)
- Total Financing: THB32,805,881 (loan balance of THB22,805,881 + THB10,000,000 in total equity)
- LTV: 0.6952 (= THB22,805,881/THB32,805,811)

3. Contrast the equity dividend rate on the Bangkok project with that of the Pandan East project, both before GP performance fees and after fees. Assume GP performance fees are equal to 20% of returns above a 15% hurdle rate upon completion for both projects.

Solution:

Equations 6 and 7 showed the equity dividend rate and before-tax cash flow:

$$\text{Equity dividend rate} = \frac{\text{Before-tax cash flow}}{\text{Property purchase price} - \text{Debt outstanding}}.$$

$$\text{Before-tax cash flow} = \text{NOI} - \text{Debt service}.$$

First, solve for before-tax cash flow by determining the Bangkok project's annual debt service. Calculate the monthly mortgage payment using

$$A = \frac{r \times \text{Principal}}{1 - (1 + r)^{-n}}$$

or the Excel PMT function. Given monthly interest of 0.56667% (= 6.80%/12), a term of 240 months, and mortgage principal of THB41,250,000, we can calculate the monthly mortgage payment of THB314,878:

$$A = \text{THB}314,878 = \frac{0.0056667 \times \text{THB}41,250,000}{1 - (1 + 0.056667)^{-240}},$$

or PMT(0.0056667,240,41250000,0,0).

Derive annual debt service of THB3,778,531 by multiplying this result by 12. Using NOI of 6,093,360 from Question 1, solve for before-tax cash flow:

Before-tax cash flow = THB2,314,829 = 6,093,360 – 3,778,531.

Next, we solve for the equity dividend using before-tax cash flow of THB2,314,829 as the numerator and the difference between total project cost of THB54,000,000 from Question 1 and mortgage principal of THB41,250,000 (equal to the equity investment) as the denominator:

$$\text{Equity dividend rate} = 18.16\% = \frac{\text{THB2,314,829}}{\text{THB54,000,000} - \text{THB41,250,000}}.$$

This is the Bangkok project's equity dividend rate before GP performance fees. To solve for the equity dividend rate after fees, we must first determine the before-tax cash flow threshold by multiplying the denominator of Equation 6 (THB12,750,000 = 54,000,000 – 41,250,000) by the hurdle rate: Cash flow hurdle = THB1,912,500 = 0.15 × THB12,750,000.

Next, solve for fees equal to 20% of before-tax cash flow in excess of the 15% hurdle rate and deduct this from the numerator:

GP fees: THB80,466 = 0.20 × (2,314,829 – 1,912,500).

Before-tax cash flow (after fees): THB2,234,363 = 2,314,829 – 80,466.

Recalculate the equity dividend using before-tax cash flow after fees:

$$\text{Equity dividend rate (after fees)} = 17.52\% = \frac{\text{THB2,234,363}}{\text{THB54,000,000} - \text{THB41,250,000}}.$$

We can summarize equity dividend rates for the two projects as follows:

	Equity Dividend Rate (before Fees)	Equity Dividend Rate (after Fees)
Bangkok	18.16%	17.52%
Pandan East	17.02%	16.61%

Because equity dividend rates for the Bangkok project are approximately 100 bps higher than those for the Pandan East project, we might conclude that the Bangkok project is a more attractive equity investment for Asiastruct than the Pandan East project based on this measure, assuming they are otherwise similar and involve comparable risks.

PRIVATE REAL ESTATE VALUE DRIVERS AND PORTFOLIO CHARACTERISTICS

3

☐ discuss economic value drivers of private real estate investments and their role in a portfolio

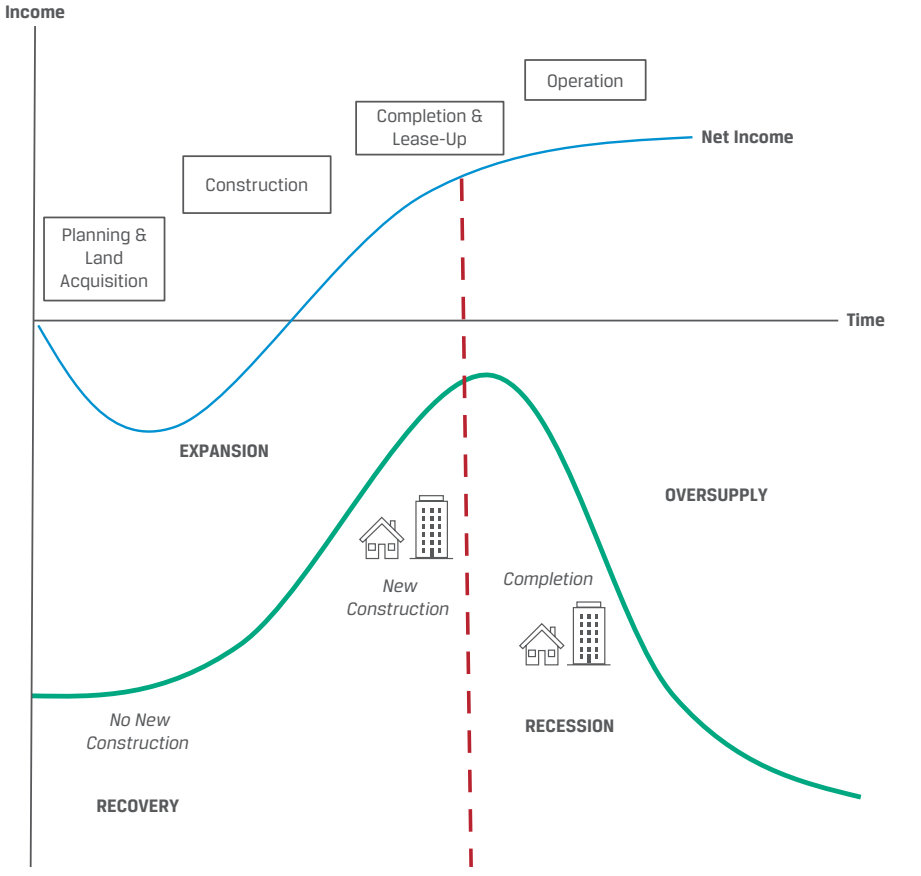
Private Real Estate Economic Value Drivers

Expected real estate income and price appreciation are determined by the current and expected future economic use of a property for residential or commercial purposes. Key economic value drivers include specific property features, such as location, age, and amenities, in addition to regional and local economic conditions.

Earlier real estate learning modules cited GDP, job growth, and wage growth as macroeconomic variables that tend to be positively correlated with rental rates and real estate prices. Local conditions enhancing the value of a property's economic use include an attractive business climate and infrastructure, favorable regulatory and tax policies, and the proximity of major suppliers, customers, and employers. Commercial real estate is an important production input for many industries, while rising employment, population growth, and consumer confidence increase demand for rental and owner-occupied housing.

Opportunistic private real estate investments involve a greater focus on expected price appreciation than income, which magnifies the importance of real estate cycle timing as an economic value driver. Earlier learning modules linked rising rental and occupancy rates as a signal to increase market supply. As private real estate investors weigh potential refurbishment and new development projects based on current market conditions, they must factor timing from project inception to completion and potential market changes into their investment decision. Exhibit 5 shows the relationship between project development phases and the real estate cycle.

Exhibit 5: Project Development and the Real Estate Cycle



As Exhibit 5 shows, a multiyear project planned and built during real estate market recovery and expansion may reach completion at an inopportune time in the real estate market as rents decline and vacancies rise. The following case study shows how changing market conditions may affect project return.

CASE STUDY

Pandan East Return over the Real Estate Cycle

Assume the Pandan East project is completed during an oversupply phase in the real estate cycle. Due to the regional multifamily housing glut, the owners must reduce average rental rates to MYR2.50 per ft^2 to reach just 85% occupancy upon completion, while the owners are unable to reduce expenses as a fraction of gross rent despite lower-than-expected occupancy.

Recall that Pandan East includes 1,200 units averaging 1,200 ft^2 each, with expenses equal to 30% of gross rent. Assume the C&D loan has been repaid using the 20-year, 7% monthly MYR206,250,000 mortgage loan proceeds.

1. Calculate the revised before-tax cash flow and equity dividend rate for the Pandan East project under the new market conditions.

   Solution:

   Calculate NOI using Equation 1 by first solving for gross rent, or revenue from full occupancy rental of the 1,200 units at the average rent/ft^2:

   Gross rent = MYR43,200,000 = (1,200 ft^2 × 1,200 units × 2.5 rent/ft^2 × 12).

   Next, subtract vacancies and operating expenses (15%, or 100% – 85%, and 30% of gross rent, respectively) from gross rent:

   NOI = MYR23,760,000 = (1 – 0.45) × MYR43,200,000.

   Recall from the previous case study that the annual mortgage debt service cost is MYR19,188,649. Solve for before-tax cash flow using Equation 7:

   NOI – Debt service = MYR4,571,351 = 23,760,000 – 19,188,649.

   Use Equation 6 to calculate the equity dividend rate:

$$\text{Equity dividend rate} = \frac{\text{Before-tax cash flow}}{\text{Property purchase price} - \text{Debt outstanding}}.$$

   While the previous result is the numerator of Equation 6, the denominator (MYR68,750,000 = 275,000,000 – 206,250,000) remains unchanged:

$$\text{Equity dividend rate} = 6.65\% = \frac{\text{MYR } 4,571,351}{\text{MYR } 68,250,000}.$$

While the completed project in the previous case study generates sufficient cash flow to meet fixed debt service obligations, a key question is whether the lower NOI is a temporary cyclical phenomenon or reflects a more permanent level of the property's earnings potential over time (sometimes referred to as **stabilized NOI**). If we assume the latter case of lower operating income for the foreseeable future, consider how the new market conditions drive economic value changes for both debt and equity investors.

Using the direct capitalization method and assuming a capitalization rate equal to the original expected project rate of return of 11.23%, we estimate the project's new value to be MYR211,576,135, using Equation 3:

$$\text{Property value} = \frac{\text{Expected NOI}}{\text{Capitalization rate}}.$$

$$\text{MYR}211,576,136 = \frac{\text{MYR}23,760,000}{0.1123}.$$

We can break down the project's estimated value further by capitalizing the residual cash flows that accrue to equityholders only, which, in this case, includes before-tax cash flow after debt service of MYR4,571,351. If we consider the 15% hurdle rate mentioned earlier in the case study as a reasonable return on equity assumption for similar projects, we may solve for the market value of project equity by modifying the equity dividend calculation in Equation 6:

$$\text{Equity dividend rate} = 15\% = \frac{\text{MYR4,571,351}}{\text{Market value of equity}}.$$

Market value of equity = MYR30,475,676.

Because total project value is the sum of equity market value and the market value of debt, we can indirectly solve for the market value of debt as MYR181,100,459:

Total project value = Market value of equity + Market value of debt. (8)

MYR211,576,135 = MYR30,475,676 + MYR181,100,459.

Note that the 23% decline in total project value involves an estimated 56% decline in equity and a 12% decline in estimated mortgage loan market value.

Finally, we may show how changing market conditions affect mortgage debt coverage and leverage. Lower NOI reduces debt service coverage (that is, results in a lower DSC ratio) for lenders versus original project assumptions:

$$\text{DSC (Original)} = 1.61 = \frac{\text{MYR 30,888,000}}{\text{MYR 19,188,649}}.$$

$$\text{DSC (Revised)} = 1.24 = \frac{\text{MYR 23,760,000}}{\text{MYR 19,188,649}}.$$

A decline in market value gives rise to higher leverage, as shown by comparing expected LTV at completion using original project cost versus revised LTV under new market conditions:

$$\text{LTV (Original)} = 0.75 = \frac{\text{MYR 206,250,000}}{\text{MYR 275,000,000}}.$$

$$\text{LTV (Revised)} = 0.97 = \frac{\text{MYR 206,250,000}}{\text{MYR 211,576,135}}.$$

Details of differences in the base case and the oversupply case are as follows:

	Average Rent (MYR)	Occupancy Rate (%)	Equity Dividend	LTV	DSC
Original Case	2.75	95%	18.16%	0.75	1.61
Oversupply	2.50	85%	6.65%	0.97	1.24

Structural changes in demand are another important economic value driver for private real estate investments. Property owners can adapt their existing assets to the evolving needs of commercial and residential end users to maximize return on their investments. In doing so, they often invest in value-add strategies that involve upgrades or changes in the economic use of an existing income-producing property, as in the following case study.

CASE STUDY

Kingston Tower NOI and Sales Price

Kingston Tower is an aging 250,000 ft^2 office building on the outskirts of Toronto with few amenities and dwindling occupancy. Given the shift to hybrid work following the COVID-19 pandemic, a real estate GP is considering the purchase and renovation of the property to capitalize on market trends by creating a mixed-use, amenity-rich coworking and luxury apartment complex. The GP's analyst reviews the following NOI calculation in Canadian dollars (CAD) for the prior year given an average base rent of CAD40 per ft^2, 90% occupancy, and revenue and expense based on a percentage of gross rent:

Kingston Tower (Prior Year)	CAD	% Gross Rent
Revenue		
Gross Rent	10,000,000	100%
Operating Expense Recovery	1,000,000	10%
Other Income	400,000	4%
Less: Vacancy	(1,000,000)	10%
Concessions	(200,000)	2%
Effective Gross Income	10,200,000	
Less: Operating Expenses		
Taxes, Insurance, Maintenance	(5,000,000)	50%
Property Maintenance Allowance	(2,000,000)	20%
Net Operating Income	3,200,000	

1. Assuming a cap rate of 12%, use the direct capitalization method to estimate the property's value based on the prior-year NOI.

   Solution:

   Use Equation 3 to solve for the property's value based on prior-year NOI:

$$\text{Property value} = \frac{\text{Expected NOI}}{\text{Capitalization rate}}.$$

$$\text{CAD}26,666,667 = \frac{\text{CAD}3,200,000}{0.12}.$$

2. The GP learns that current-year occupancy has fallen to 80% as tenants shifting to hybrid work policies fail to renew multiyear leases. Calculate expected current-year NOI and property value as in Question 1 for the current year using the same cap rate, revenue, and expense assumptions.

   Solution:

   The decline in occupancy to 80% doubles the effective gross income deduction for vacancy from 1,000,000 to 2,000,000 (= 20% × CAD10,000,000), while other revenue and expenses are unchanged since gross rent does not change.

Solve for current-year NOI of CAD2,200,000 by subtracting the CAD1,000,000 decrease in income from prior-year NOI (= 3,200,000 – 1,000,000).

$$\text{Property value} = \frac{\text{Expected NOI}}{\text{Capitalization rate}}.$$

$$\text{CAD}18,333,333 = \frac{\text{CAD}2,200,000}{0.12}.$$

3. Evaluate the appropriateness of using the direct capitalization method from a seller versus buyer perspective in this example.

   Solution:

   The direct capitalization method is appropriate if the NOI used in the numerator of Equation 3 reflects a normalized level of the property's earnings potential, which is expected to be constant over time. This may be a reasonable assumption from the seller's perspective if the seller believes the structural change in demand is permanent and there are no plans to change the property's economic use. While the GP buyer may use this method as an estimate of value to a seller based on current cash flows and economic use, the buyer may use other valuation approaches to determine the price it is willing to pay.

Investors in value-add real estate strategies aim to acquire an existing property and invest funds to implement changes that increase income and property value beyond expectations based on current economic use. A seller may be unable to identify such opportunities, may not be able or willing to capitalize on them due to a lack of expertise or financing, or have a limited risk appetite. The prospective buyer need not pay the seller a premium for the possible value it brings to a transaction. The highest bidder for a property expects the greatest return on those value drivers and is able and willing to assume the associated execution risk. The following case study shows the prospective purchase price a potential investor might be willing to pay based on a target hurdle rate.

CASE STUDY

Kingston Tower Refurbishment Project

The Kingston Tower renovation involves the conversion of upper floors totaling 50,000 ft^2 into luxury apartments and the remaining 200,000 ft^2 into high-end coworking spaces with full amenities based on the following timeline:

- Year 0: Purchase property
- Year 1: Operate office building at 80% occupancy while obtaining all permits and rezoning approvals. Assume first-year NOI (NOI_1) of CAD2,200,000 from the previous case study.
- Year 2: Renovate vacant floors while operating remainder of office building under existing leases. Renovation costs exceed second-year NOI (NOI_2) for a net cash flow of (CAD2,000,000).
- Year 3: Complete renovation and initiate new coworking and residential leases and operations. Renovation costs to exceed third-year NOI (NOI_3) for a net cash flow of (CAD2,000,000).
- Year 4: Coworking and residential space fully operational, with stabilized fourth-year NOI (NOI_4) of CAD6,412,500 based on

- Coworking base rent CAD55/ft^2, residential base rent CAD50/ft^2
- 95% occupancy
- Revenue and expense assumptions as follows:

Kingston Tower (Post-Renovation)	CAD	% Gross Rent
Revenue		
Gross Rent	13,500,000	100%
Operating Expense Recovery	1,350,000	10%
Other Income	607,500	4.5%
Less: Vacancy	(675,000)	5%
Concessions	(270,000)	2%
Effective Gross Income	14,512,500	
Less: Operating Expenses		
Taxes, Insurance, Maintenance	(6,750,000)	50%
Property Maintenance Allowance	(1,350,000)	10%
Net Operating Income	6,412,500	

1. Assuming a capitalization rate of 17%, solve for the expected property value at the end of three years based on the NOI once renovation is complete using the direct capitalization method.

   Solution:

   Use Equation 3 to solve for the property's expected value in three years based on NOI in Year 4:

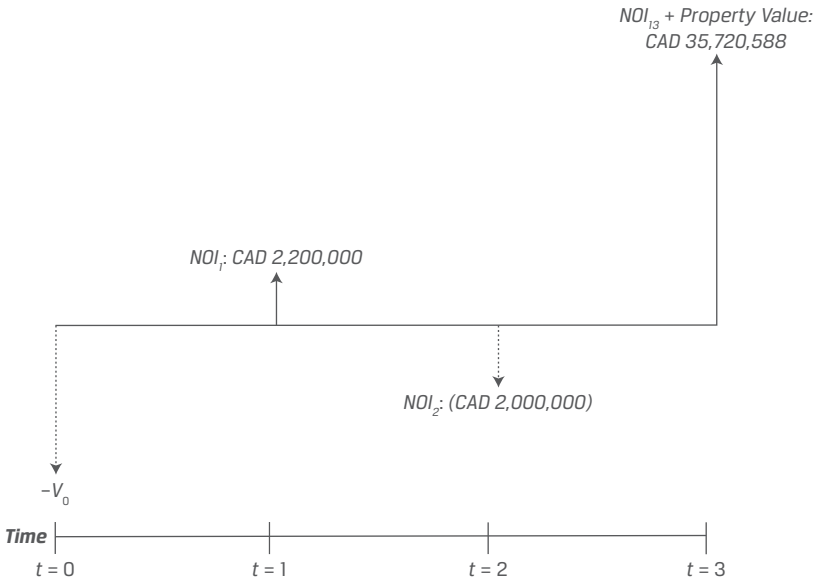
$$\text{Property value} = \frac{\text{Expected NOI}_4}{\text{Capitalization rate}}.$$

$$\text{CAD}37,720,588 = \frac{\text{CAD}6,412,500}{0.17}.$$

2. Given the expected project cash flows, what should the GP be willing to pay for the property today to achieve a hurdle rate of 17%?

   Solution:

   Given both the expected future cash flows and the 17% hurdle rate, we can use an internal rate of return (IRR) calculation to solve for the property value V_0 that would result in a 17% IRR:



This may be solved using a financial calculator or the Microsoft Excel IRR function [=IRR(*values,guess*)]. We enter an estimated value for V_0 and solve for IRR, and then, using the Goal Seek function in Excel or trial and error on a calculator, we can iterate a new solution for V_0 for which the IRR of all cash flows is 17%. For example, assuming an initial price of CAD20,000,000, we enter IRR(-20000000,2200000,-2000000,35720588) and can solve for IRR of 22.28%. Using trial and error or the Goal Seek function to arrive at an IRR of 17% by changing V_0, we can solve for V_0 of approximately CAD22,725,000.

Private Real Estate Portfolio Characteristics

Private real estate investment projects typically involve construction or renovation following the acquisition of land or existing property to increase income and capital appreciation potential. Value-add investors usually focus on renovating and repositioning existing income-generating real estate assets, while opportunistic strategies entail new development or repurposed properties with longer periods of investment and negative cash flow. In both cases, these property changes over an investment life cycle entail greater risk but also higher expected return than the more stable, lower returns associated with operating and maintaining income-producing properties.

As in the case of other private markets where acquisition of assets or companies is followed by an investment or restructuring period to increase profitability, private real estate fund portfolios are typically characterized by multiyear cash calls or commitments, deployment of committed funds, and eventual realization of returns only once projects are completed and sold.

In addition to earmarking an existing investment allocation to fund future drawdowns, investors entering private real estate transactions must be willing to accept long investment time horizons over which the investment is illiquid and its net asset value (NAV) is relatively uncertain given the limited ability to sell a property during the construction or renovation phase.

While an underlying property or properties may be more difficult to buy or sell prior to completion, an increasing number of LP investors sell underlying fund interests to new investors in the secondary market. Similar to private equity secondaries, these transactions offer existing LP investors an ability to liquidate and diversify their holdings prior to a fund's termination date, while new investors may be attracted by

shorter investment horizons, the ability to acquire a position at a price below the current NAV, and access to otherwise unavailable investments. General partners also often have an interest in leading secondary transactions to promote liquidity or rebalance an existing portfolio. In other cases, GPs offer interval funds with a limited number of fund redemptions or repurchases prior to termination. Many such open-end funds are offered for sale by LPs on the secondary market. While these GP provisions offer investors a degree of liquidity under normal market conditions, this source of liquidity may become unavailable during periods of market stress, as in the following case.

BLACKSTONE REIT (BREIT) REDEMPTION RESTRICTIONS

In 2017, Blackstone, the world's largest private real estate firm, launched the Blackstone Real Estate Income Trust (BREIT) in order to provide high-net-worth individuals access to private market real estate investments. BREIT grew to USD69 billion in assets under management over five years and contributed approximately 17% of Blackstone's earnings. As interest rates rose in 2022, publicly traded REIT prices fell, while BREIT continued to show significant positive returns. As a result, individual investors in BREIT increasingly sought to withdraw funds in late 2022, with the demand for withdrawals exceeding Blackstone's redemption limits. The contract underlying the BREIT fund allows for monthly investor redemptions of no more than 2% of fund value and quarterly redemptions of 5%. These limits were reached in November 2022, and as a result, less than half of investor repurchase requests could be satisfied by Blackstone for several months.

The BREIT situation highlights a number of issues related to private versus public real estate investments. The increased demand for BREIT redemptions led more investors to submit redemption requests for BREIT shares and other non-traded REITs. Investors who are able to move their money out of BREIT may find more attractive valuations in publicly traded REITs. Those investors whose redemption requests are not met often seek to offer their position on the secondary market. Alternative private trading platforms have sought to establish their own secondary markets for BREIT and similar non-traded REITs, reducing GP control over LP fund access previously controlled by selling agreements.

QUESTION SET

Questions 1–4 are based on the following information.

Alyssa Tan, a senior analyst at Asiastruct, considers how a debt or equity investment in the THB54 million Bangkok project would be affected if its completion coincides with an oversupply in the local real estate market. She develops the following table to compare data from the original project assumptions from the previous lesson with an oversupply scenario in which rents fall 10%, vacancies increase from 5% to 15%, and operating expenses rise from 33% to 35% of gross rent:

	Original Assumptions Year 3 (THB)	Oversupply Scenario Year 3 (THB)
Rent per ft^2 (monthly)	0.65	0.585
Gross Rent (total units)	9,828,000	8,845,200
Less: Average Vacancy	491,400	1,326,780

	Original Assumptions Year 3 (THB)	Oversupply Scenario Year 3 (THB)
Effective Gross Income	9,336,600	7,518,420
Operating Costs	3,243,240	3,095,820

We continue to assume that the project is financed with THB12,750,000 in equity and THB41,250,000 in debt financing with a 20-year 6.80% mortgage. Key calculations from the project base case are as follows:

Net Operating Income	6,093,360
Annual Debt Service	3,778,531
Before-Tax Cash Flow	2,314,829

Assume that the property's capitalization rate is 11.28% and the equity dividend rate is 18.16%.

1. By what percentage does before-tax cash flow decline from the original assumptions in the oversupply scenario?

   A. 22.0%

   B. 27.8%

   C. 72.2%

   Solution:

   Response C is correct. Subtract operating costs from effective gross income to solve for NOI of THB4,422,600 in the oversupply scenario versus THB6,093,360 in the original case. Deducting the debt service costs from the revised NOI results in before-tax cash flow of THB644,069. Comparing this number to the original before-tax cash flow of THB2,314,829, we find a 72.2% decline [= (2,314,829 – 644,069)/2,314,829].

2. Calculate and interpret the revised equity dividend rate of the Bangkok project.

   Solution:

   We can substitute the revised before-tax cash flow into Equation 6 to solve for the revised Bangkok project equity dividend rate:

   $$5.05\% = \frac{\text{THB644,069}}{\text{THB12,750,000}}.$$

   The equity dividend rate also declines by 72.2% from 18.16% to 5.05% as a result of the decline in before-tax cash flow.

3. Calculate and interpret the LTV ratio of the Bangkok project upon completion under the revised scenario. Continue to assume a capitalization rate of 11.28%.

   Solution:

   To determine the LTV ratio, we must first calculate the property value using expected Year 3 NOI as in Equation 3:

   $$\text{Property value} = \frac{\text{Expected NOI}_3}{\text{Capitalization rate}}.$$

$$\text{THB}39,200,000 = \frac{\text{THB}4,422,600}{11.28\%}.$$

Next, solve for LTV by dividing the THB41,250,000 loan amount by the revised property value:

$$\text{LTV} = 1.05 = \frac{41,250,000}{39,200,000}.$$

An LTV above 1 implies that the face value of the loan exceeds the property value. We would therefore expect the debt to be priced at a discount to its face value in this scenario.

4. Suppose that Alyssa Tan's oversupply scenario presented previously is a temporary rather than permanent market phenomenon in the local rental market. Discuss the bias created by the analysis conducted in Questions 1–3.

Solution:

The prior three questions used the oversupply assumptions to calculate a stabilized NOI and before-tax cash flow. If this situation is temporary, the analysis in Questions 1–3 generates an overly pessimistic view of the Bangkok property's long-term value. As future NOI and before-tax cash flow is expected to recover, a discounted cash flow analysis for the transition period to a higher stabilized NOI would reflect a more realistic and higher valuation for the property equity and debt.

PRIVATE REAL ESTATE DUE DILIGENCE AND VALUATION

4

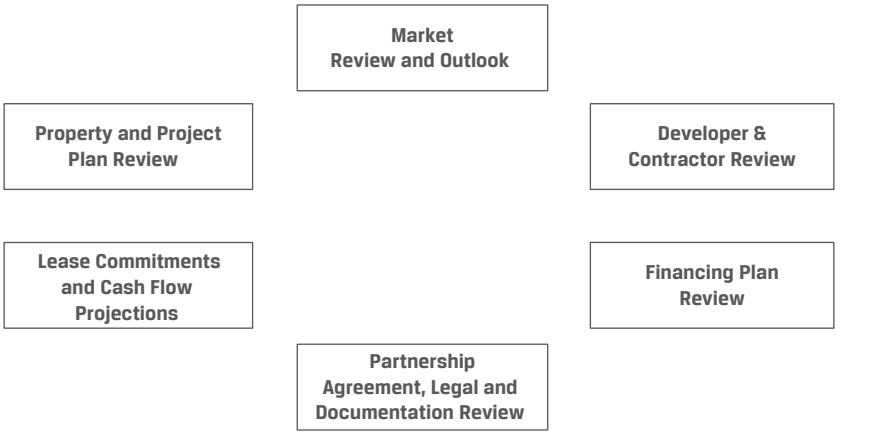
☐ discuss the due diligence and valuation processes for private real estate

Earlier real estate learning modules stressed the importance of evaluating a property's physical attributes and costs of operation, as well as expected rental rates and future market dynamics affecting income and potential capital appreciation. More complex investment structures and the construction and financing life cycle of a refurbished or newly developed property add further dimensions to the due diligence process for private real estate. While real estate valuation approaches are like those for other private market assets, private markets may incorporate option- or scenario-based analysis in addition to more conventional income, cost, and sales comparison approaches.

Private Real Estate Due Diligence

Key elements of private real estate due diligence for a newly developed property are outlined in Exhibit 6.

Exhibit 6: Elements of Private Real Estate Due Diligence



Market Review and Outlook

Regional and local business outlooks are an important gauge of future commercial and residential real estate demand. While due diligence for income-producing properties focuses primarily on current sale prices and lease rates and trends, opportunistic property investors also consider comparable prices of undeveloped land or properties targeted for refurbishment, as well as construction costs. Forward projections of real estate cycle dynamics as a project reaches completion are important for estimating future income, while in the case of value-add real estate renovation projects, improved local economic conditions may be necessary to generate higher rental and lease income following capital improvements. Community engagement, the anticipated arrival or departure of major employers, or similar development in the area, as well as changes to public infrastructure, are additional factors to consider.

Property and Project Plan Review

Investors typically review property surveys and physical, engineering, and environmental feasibility studies, as well as construction plans and details. In addition to the reputation and experience of the architecture and engineering (A&E) firm serving as technical consultant, coordination and integration of the design and construction process are key factors affecting the timely completion of a project within the original budget.

Developer, Contractor, and Supplier Review

Investors depend heavily on close cooperation between developers, general and specialty contractors, and suppliers during the construction phase. In some cases, an A&E firm or general contractor agrees to deliver a project on a **turnkey** or fully completed basis, which can streamline the process but also concentrates execution risk. In other cases, work occurs in stages, with progress payments made at key milestones. Important factors to consider include the experience of contractors on similar projects, past partnership with involved parties (as well as their financial strength), adherence to safety measures, alignment of incentives, and adequate liability insurance.

Lease Commitments and Cash Flow Projections

The level and variability of property income will vary widely depending on the business strategy, type of property, and lease commitments in place upon completion. For example, a project may be built to suit a single commercial tenant with a pre-signed rental contract, have one or two major retailers committed to leases in a multi-tenant shopping facility, or be constructed on a purely speculative basis with no predevelopment leases in place. Other base-case assumptions supporting income and expense forecasts should be critically evaluated, including possible construction or lease delays or other adverse events.

Financing Plan Review

Potential debt and equity investors may take a similar approach in assessing the level and variability of future cash flows but often view associated risks and considerations very differently based on their position in the project's capital structure and life cycle timing.

*ADLs and C&D Loans.*Investors in debt drawn during the land purchase, development, and construction phases of a project focus specifically on the nature of costs funded, expected financial leverage, and the commitment and timing of permanent debt financing. For example, these investors have greater risk when drawdowns are for fees or project management costs as opposed to land and building materials expenses, outlays that are more likely to be recouped in the sale of an unfinished project. The probability of default for such loans is greater for projects that rely more heavily on debt financing or that lack a firm mortgage commitment upon completion. Early-stage lenders pay particular attention to the financial condition of developers, loan covenants, and completion of project milestones over time.

Mortgage Loans. Permanent lenders evaluate the degree of upfront commitment, as well as the expected and actual debt coverage, leverage, and the profitability of the completed project. Firm loan commitments at rates or spreads fixed prior to project completion carry greater risk because they must rely on the value of the undeveloped land only, while standby commitments usually allow for adjusted market rates and other terms upon loan disbursal. Mortgage prepayment features give rise to reinvestment risk for lenders.

Equity. Prospective equity investors must balance the higher return of projects with greater leverage and financial flexibility with the risk-reducing benefits that financially sound debt providers able to meet debt drawdowns typically impose, such as leverage- and covenant-based constraints. Equity owners must understand the consequences of debt drawdowns not occurring or a loan not closing and be prepared to potentially inject additional equity to bridge the project or walk away and lose their existing equity investment.

Partnership Agreement, Legal, and Documentation Review

Private real estate investments often involve a partnership agreement that governs shareholder rights, such as voting or GP appointment rights; financial disclosures; and sale restrictions, such as lockup provisions. This review also extends to compensation arrangements seeking to align manager and investor incentives. Prospective LP investors must weigh the potential risks of earlier involvement, concentration in larger investments, and/or longer lockup periods against greater rewards offered by GPs for such positions. As in the case of public investments, a legal and tax review of ownership history ensures that a property is free of any liens or tax obligations to protect the new owner and secured lenders.

Private Real Estate Valuation Approaches

Private real estate valuation incorporates elements of the income, cost, and sales comparison approaches introduced in earlier learning modules that are used to value public real estate and other private market assets. Factors that distinguish the valuation of private real estate include property development life cycle dynamics, the future state of the real estate market, and the income and capital appreciation of a completed project. In addition, real options are associated with an investor's ability to alter a planned course of action in response to changing market conditions, as shown later.

Private real estate investors often apply more than one valuation approach to arrive at a price at which they may be willing to buy or sell a property over the development life cycle, with the preferred method varying based on an investor's position and property characteristics.

For example, an income-based approach is most appropriate when earnings are considered the primary source of value based on the property's current or future economic use. The single-year NOI in the numerator of the direct capitalization method described earlier and shown in Equation 3 implicitly assumes consistent earnings in the future. In the case of new development, direct capitalization was used earlier to gauge the Pandan East property's post-completion value based on future earnings under its new economic use. Given the lack of cash flows from the vacant three-acre plot used for the project, it is not current earnings but, rather, the potential for development from which the raw land derives its value. In this case, a market price comparison to other nearby comparable properties available for development is more suitable than an income valuation approach.

In the earlier Kingston Tower case study, an existing income-producing property is under consideration for major renovation under a value-add investment strategy. Recall that previously, the direct capitalization method was used to compare the difference in the value of the cash flow stream under the property's current use and the expected cash flows after renovation. Investors typically demand a higher return in the construction phase versus the cap rate for a stabilized NOI. In practice, both the seller and buyer are also likely to consider more than one valuation approach. For example, given uncertainty surrounding future office occupancy, the seller may look to a sales comparison or market approach by considering prices at which similar or comparable properties recently traded. In addition to considering other renovation targets, the buyer may also consider the cost of new development versus renovation. The cost approach involves evaluating the expense of buying the land and constructing a new property on the site that has the same economic use as the property being appraised (referred to as the subject property). The following case study illustrates these approaches.

CASE STUDY

Kingston Tower Seller and Buyer Valuation Approaches

The seller uses a sales comparison approach based on public records or other data sources to compare prices per square foot of three comparable properties, adjusting for differences from the subject property in terms of size, age, location, and market conditions at times of sale.

Measure/Property	Subject Property (Kingston Tower)	Comparable Property 1	Comparable Property 2	Comparable Property 3
Sale Date		6 months	9 months	18 months
Sale Price		28,895,000	21,295,000	13,575,000
Gross Annual Rent		13,500,000	9,250,000	8,795,000
Gross Square Feet	250,000	325,000	225,000	220,000
Rent/ft^2		24	26	27.27
Additional Distance from City Center	0 miles	3 miles closer	2 miles further	4 miles further
Age	25y	15y	20y	30y
Price/ft^2		88.91	94.64	61.70
Adjustments:				
Sale Date		0%	4%	8%
Square Footage		5%	–1%	–2%
Location		–5%	5%	8%
Age		–10%	–5%	5%
Net Difference		–10%	3%	19%
Adjusted Price		26,005,500	21,933,850	16,154,250
Adjusted Price/ft^2		80.02	97.48	73.43
Estimated Price/ft^2 for Subject Property		83.64		
Estimated Value (CAD)		20,910,759		

Using a cost approach, the buyer estimates the price of purchasing vacant land and developing a comparable property with the same rental space and economic use following the proposed renovation, while adjusting for the difference between a new building and an older, renovated building.

Estimate Components	Estimate (CAD)
Excavation and steel framing	1,000,000
Foundation	1,250,000
Façade (glass, brick, mortar)	2,400,000
Floor finishing	950,000
Roofing/ceiling/insulation	1,500,000
Interior walls and finishing	2,000,000
Electrical and lighting	1,750,000
Plumbing	1,175,000
HVAC (heating, ventilation, and A/C)	1,200,000
Interior furnishing	2,250,000
Parking and paving	500,000
SUBTOTAL	15,975,000
Architect/legal/tax/permits/accounting	1,250,000
Development period interest	1,250,000

Estimate Components	Estimate (CAD)
Contractor profit	2,700,000
SUBTOTAL	5,200,000
Comparable land cost	4,950,000
Cost estimate for new building	26,125,000
Adjustment for age of subject property (–15%)	22,206,250

Recall from the previous case study that the GP investor is targeting a 17% hurdle rate and expects the following cash flows during renovation and upon completion:

- Year 1: Assume NOI_1 of CAD2,200,000
- Year 2: Renovation costs exceed NOI_2, net cash flow of –CAD2,000,000.
- Year 3: Renovation costs exceed NOI_3, net cash flow of –CAD2,000,000.
- Year 4: Stabilized NOI_4 of CAD6,412,500 at 95% occupancy

1. Using estimated property price based on values derived under the sales comparison and cost approaches, determine whether the GP investor should pursue the Kingston Tower project given its stated hurdle rate.

Solution:

In Question 2 in the previous case study, we calculated a property price V_0 of CAD22,725,000 for which the IRR of all cash flows equaled the GP's hurdle rate of 17%. Given the lower estimated V_0 using the sales comparison and cost approaches—CAD20,910,759 and CAD22,206,250, respectively—the expected IRR is above 17% and the GP investor would pursue the project under either valuation scenario, as shown below:

Sales comparison approach:

IRR = 20.4% [=IRR(-20910759,2200000,-2000000,35720588)].

Cost approach:

IRR = 17.9% [=IRR(-22206250,2200000,-2000000,35720588)].

The valuation approaches shown thus far are relatively straightforward given their *static* nature; that is, they capture a property's value by discounting a single year's cash flow as a perpetuity or a ratio comparing sales based on a common unit of measure. When an analyst seeks to capture cyclical or multiperiod trends, a *dynamic* approach based on discounting a series of income projections and a terminal value to the present is more appropriate. The discounted cash flow (DCF) method is applied when an analyst has sufficient information to estimate property cash flows over several years. Earlier learning modules showed the property value using DCF as a combination of forecasted NOI and a terminal value on a future date.

$$\text{Property value} = \sum_{i=1}^{n} \frac{\text{NOI}_{t+i}}{(1+r)^i} + \frac{\text{Terminal value}}{(1+r)^n}. \quad (9)$$

Terminal values can be derived by capitalizing the NOI of comparable properties or using the final year's projected NOI multiplied by 1 plus the constant growth rate, *g*, discounted by the cap rate:

$$\text{Terminal value} = \frac{\text{NOI}_n(1+g)}{r-g}. \tag{10}$$

We illustrate this for a secondaries LP investor evaluating the purchase of the beleaguered Pandan East development described earlier, where we assumed project completion amid a real estate market in an oversupply phase.

CASE STUDY

DCF Valuation of Pandan East Secondaries Purchase

Recall from earlier the situation in which Pandan East is completed during a real estate market glut, forcing the owner to rent new units at an average MYR2.50 per ft^2 and reach just 85% occupancy versus an expected MYR2.75 per ft^2 and 95%, respectively, under the original plan for the first year after completion.

Pandan East includes 1,200 units averaging 1,200 ft^2 each, with expenses equal to 30% of gross rent. The first full year's NOI may be shown as follows:

Pandan East (Year 0)	MYR	% Gross Rent
Revenue		
Gross Rent	43,200,000	100%
Other Income	0	0%
Less: Vacancy	(6,480,000)	15%
Effective Gross Income	36,720,000	
Less: Operating Expenses	(12,960,000)	30%
Net Operating Income	23,760,000	

While the GP contract and business plan foresee four more years of ownership before exit, an original LP investor is soliciting secondary market bids from new LP investors. An analyst conducting due diligence on the purchase of an equity stake in Pandan East projects the following rent and occupancy rates:

Period	Average Rent (MYR)	% Occupancy
Year 1	2.60	90%
Year 2	2.75	95%
Year 3	2.85	95%
Year 4	3.00	95%

The LP analyst assumes no added income and expenses equal to 30% of gross rent, as well as a required rate of return of 12% and a 2% constant growth rate starting at the end of four years.

1. Calculate the present value (PV) of NOI over the four-year holding period.

   Solution:

   First, project Year 1 to Year 4 cash flows based on LP analyst assumptions:

Pandan East NOI Projections

NOI Components	Year 1	Year 2	Year 3	Year 4
Average Rent	2.60	2.75	2.85	3.00
Occupancy	90%	95%	95%	95%
Gross Rent	44,928,000	47,520,000	49,248,000	51,840,000
Other Income	—	—	—	—
Less Vacancies	(4,492,800)	(2,376,000)	(2,462,400)	(2,592,000)
Effective Gross Income	40,435,200	45,144,000	46,785,600	49,248,000
Operating Expenses	(13,478,400)	(14,256,000)	(14,774,400)	(15,552,000)
NOI	26,956,800	30,888,000	32,011,200	33,696,000

Second, calculate the PV of NOI using the first expression in Equation 9,

$\sum_{i=1}^{n} \frac{\text{NOI}_{t+i}}{(1+r)^i}$, where $r = 12\%$,

or in Excel using the NPV function [=NPV(*rate,value1,value2…*)] with a rate of 12% and values equal to each annual NOI to get MYR92,891,653:

$$\text{MYR}92,891,653 = \frac{26,956.800}{(1.12)^1} + \frac{30,888,000}{(1.12)^2} + \frac{32,011,200}{(1.12)^3} + \frac{33,696,000}{(1.12)^4}.$$

2. Calculate the terminal value based on Year 4 NOI and the expected price the new LP investor would be willing to pay for the property.

Solution:

Use Equation 10 to solve for terminal value using NOI_4 of MYR33,696,000, r of 12%, and g equal to 2% to derive a future terminal value of MYR343,699,200:

$$\text{Terminal value} = \frac{\text{NOI}_4(1+g)}{r-g}.$$

$$\text{MYR}343,699,200 = \frac{33,696,000(1.02)}{0.12-0.02}.$$

Substitute this result into Equation 9 to estimate the property's value to the LP investor by combining the PV of NOI with the terminal value PV:

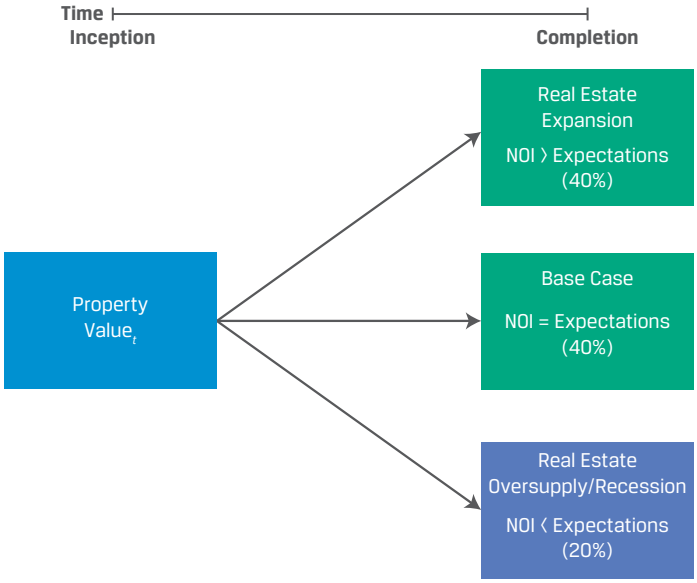
$$\text{Property value} = \text{MYR}311,318,708 = \text{MYR}92,891,653 + \frac{\text{MYR}343,699,200}{(1.12)^4}.$$

A detailed cash flow forecast over multiple periods under a single likely economic scenario is most suitable for properties or companies with relatively stable income sources that do not change over the forecast period, as in the prior case study. When greater uncertainty exists over a development cycle coupled with potential real estate market changes during the construction phase, a valuation based on **scenario analysis** may be more appropriate. Scenario analysis combines a base case with alternative outcomes, allowing the incorporation of more favorable or adverse scenarios in the valuation process.

$$\text{Property value} = \sum_{i=1}^{n} \text{Probability}(i) \times \text{Property value}_i. \quad (11)$$

In Equation 11, the property's value under scenario i (Property value$_i$) is weighted by its respective probability, Probability(i), and $\sum_{i=1}^{n}$ Probability(i) = 1. For example, at project inception, a prospective investor might consider the three potential scenarios upon completion shown in Exhibit 7.

Exhibit 7: Private Real Estate Valuation Using Scenario Analysis



While the valuation method used in Equation 11 for all scenarios must be consistent, it may involve income-, cost-, or market-based approaches. We illustrate the use of scenario analysis by revisiting the Kingston Tower refurbishment project using direct capitalization.

CASE STUDY

Kingston Tower Scenario Analysis

An analyst weighing a Kingston Tower investment examines prospective returns under different market rent assumptions. Since she believes the high-end coworking rental market is more cyclical than residential real estate, she establishes three scenarios upon project completion under which coworking rent exhibits greater variability as follows:

Scenario/Probability	Coworking Rent (CAD/ft^2)	Residential Rent (CAD/ft^2)
Expansion (25%)	60	55
Base (40%)	55	50
Downside Case (35%)	45	50

The analyst assumes 95% occupancy in all three cases and similar income and expense assumptions as before. Recall the project includes 50,000 ft^2 of luxury apartment space and 200,000 ft^2 of coworking space developed over

three years, with NOI_1 of CAD2,200,000 and net cash flow of –CAD2,000,000 in Years 2 and 3. The analyst calculates post-completion NOI in Year 4 under each of the three scenarios as follows:

Cash Flow Item/ Scenario	Upside Case (Expansion)	Base Case	Downside Case (Over-supply/ Recession)	% Gross Rent
Revenue				
Gross Rent	14,750,000	13,500,000	11,500,000	
Operating Expense Recovery	1,475,000	1,350,000	1,150,000	10%
Other Income	663,750	607,500	517,500	4.5%
Less: Vacancy	(737,500)	(675,000)	(575,000)	5%
Less: Concessions	(295,000)	(270,000)	(230,000)	2%
Effective Gross Income	15,856,250	14,512,500	12,362,500	
Less: Operating Expenses	(7,375,000)	(6,750,000)	(5,750,000)	50%
Less: Property Maintenance Allowance	(1,475,000)	(1,350,000)	(1,150,000)	10%
Net Operating Income	7,006,250	6,412,500	5,462,500	

1. Calculate the expected property value under the three possible scenarios at the end of Year 3 using a direct capitalization approach and a 17% required rate of return.

Solution:

We first calculate the property's value at the end of Year 3 under each scenario using Equation 3:

$$\text{Property value} = \frac{\text{Expected NOI}}{\text{Capitalization rate}}.$$

$$\text{Property value}_{Upside} = 41,213,235 = \frac{7,006,250}{0.17}.$$

$$\text{Property value}_{Base} = 37,720,588 = \frac{6,412,500}{0.17}.$$

$$\text{Property value}_{Downside} = 32,132,353 = \frac{5,462,500}{0.17}.$$

Next, solve for an expected property value of CAD36,637,868 using probability-weighted capitalized values as shown in Equation 11:

$$\text{CAD}36,637,868$$
$$= (0.25 \times 41,213,235) + (0.40 \times 37,720,588) + (0.35 \times 32,132,353).$$

Note that this expected value is less than the original base-case estimate of CAD37,720,588 from before due in part to the higher probability (35%) associated with the downside versus upside case.

2. If we assume a purchase price (V_0) of CAD22,000,000, determine the likelihood of the investor reaching or exceeding her 17% target IRR.

   Solution:

   We can determine the rate of return under each scenario using the same Excel IRR formula [=IRR(*values,guess*)] as before, with *value1* equal to V_0 of CAD22,000,000 and *value4* equal to the respective terminal value under each scenario:

   Upside case (25%):

   IRR = 22.10% [=*IRR*(-22000000,2200000,-2000000,39213235)]

   Base case (40%):

   IRR = 18.31% [=*IRR*(-22000000,2200000,-2000000,35720588)]

   Downside case (35%):

   IRR = 11.68% [=*IRR*(-22000000,2200000,-2000000,30132353)]

   This implies that the investor has a 65% chance (= 25% + 40%) of reaching or exceeding a 17% IRR on the prospective investment under these assumptions.

A key advantage of scenario analysis is that it considers a range of future potential outcomes rather than a single point estimate. Establishing a range of outcomes allows analysts to incorporate changing market conditions or other factors more explicitly into a valuation approach. Given the heterogeneous and illiquid nature of real estate markets, pursuing a simpler approach by forecasting fewer scenarios and individual variables is usually preferable to the greater financial modeling detail used in valuing public market securities.

In addition, **sensitivity analysis** is often used to determine the impact of a change in one or more key variables affecting investment return. For instance, given the focus on both coworking and residential rent as two key drivers of expected property value in the previous case study, we may create a two-variable Excel data table to examine how different values of these variables affect the expected property value assuming a 17% cap rate, as shown in Exhibit 8.

Exhibit 8: Kingston Tower Sensitivity Analysis: Property Value

Coworking rent (CAD per ft^2)	Residential Rent (CAD per ft^2)		
	55	**50**	**45**
65	50,955,882	49,485,294	48,014,706
60	45,073,529	43,602,941	42,132,353
55	39,191,176	**37,720,588**	36,250,000
50	33,308,824	31,838,235	30,367,647
45	27,426,471	25,955,882	24,485,294
40	21,544,118	20,073,529	18,602,941

Base Case*:* CAD37,720,588

Note that the base case corresponds to the scenario under which coworking and residential rent are CAD 55 and CAD 50 per ft^2, respectively. An alternative use of sensitivity analysis in this example would be to consider how the expected IRR would

vary if the property were purchased for CAD22,725,000 as originally assumed associated with different coworking and residential rent assumptions for the terminal value in Year 4 as shown in Exhibit 9.

Exhibit 9: Kingston Tower Sensitivity Analysis – Expected IRR

Coworking Rent (CAD per ft^2)	Residential rent (CAD per ft^2)		
	55	**50**	**45**
65	30.13%	28.80%	27.44%
60	24.64%	23.18%	21.70%
55	18.60%	**17.00%**	15.34%
50	11.88%	10.07%	8.19%
45	4.23%	2.13%	–0.06%
40	–4.76%	–7.29%	–9.97%

Base Case: IRR = 17%

As in Exhibit 8, the 17% IRR base case corresponds to the scenario with coworking and residential rent of CAD55 and CAD50 per ft^2, respectively.

Under the real estate valuation approaches described thus far, an investor chooses a single, pre-determined course of action. In practice, investors face multiple investment alternatives that can affect a property's value, known as **real options**. As described earlier in the curriculum, real options involve the right but not the obligation to take future action. A firm or investor should choose to pursue a real option only if it increases value.

In the case of real estate development, real options available to investors purchasing land or a property for possible upgrade often include the following:

- **Delay option**: Developers may increase a project's present value by postponing property construction until market conditions improve.
- **Sequencing option**: Dividing and executing a project in staggered phases rather than all at once may increase a project's risk-adjusted return by reducing exposure to market oversupply during the lease-up period.
- **Switching option**: The option to choose among alternative projects for a given plot of land or switch economic uses for an existing project, such as a mixed-use facility, may increase value.

Investors may use different methods to factor these alternatives into valuation:

1. Conduct a DCF analysis *without* options. If the project IRR meets an investor's hurdle rate without including options that would increase its NPV, then the NPV without options represents the *minimum* return.
2. Calculate NPV with real options. Under this approach, the firm calculates project NPV based on expected cash flows and then subtracts the incremental cost of real options and adds back its value, as shown in Equation 12:

$$\text{Project NPV} = \text{NPV (without options)} - \text{Option cost} + \text{Option value}. \quad (12)$$

3. Use a decision tree or option pricing model. Either approach may be used to assess the value of a project involving future sequential decisions and alternative outcomes. These models often assign probability and expected timing to future outcomes used to calculate the project's NPV.

The decision as to whether to delay a project is illustrated in the Knowledge Check below.

KNOWLEDGE CHECK: PROJECT TIMING DECISION

An investor in vacant land is weighing the decision of whether to build today or delay construction for one year. Estimates of current and future costs and real estate market prices are as follows:

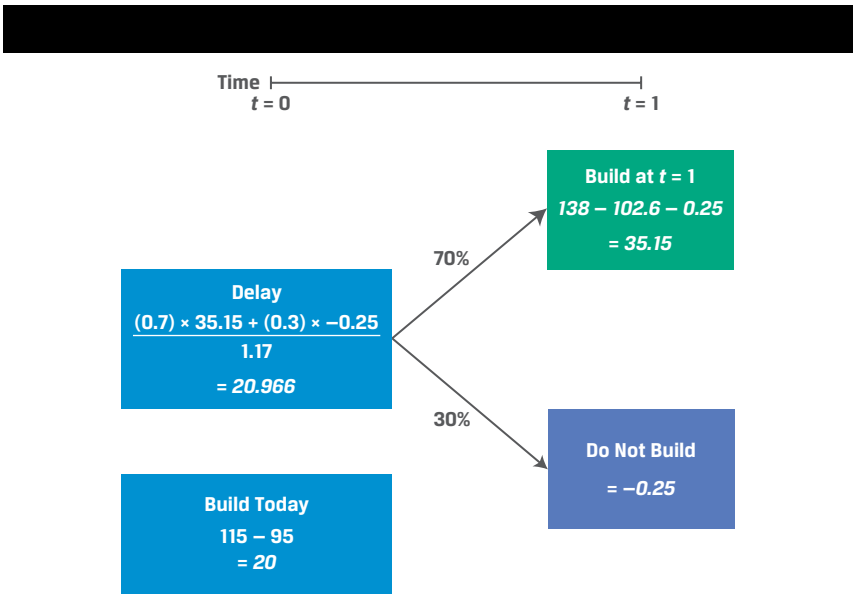
Build today: Construction costs today are USD95,000,000, and the completed building value is expected to be USD115,000,000 in present value terms.

Build in one year: The investor estimates a 70% probability of continued real estate market expansion and a 30% chance of a downturn, in which case the project will not be built, and the owner incurs USD250,000 in property taxes in either scenario. Under the expansion scenario, construction costs (including financing) are expected to rise 8%, while the completed building value will increase by 20%.

1. If the investor has a required rate of return of 17%, determine whether the investor should build the project today or delay for one year.

   Solution:

   The decision of whether to build today or delay involves a comparison of today's return to the present value of construction delay based on the following decision tree and modification of Equation 11:



   Build today:

   USD20,000,000 = USD115,000,000 – USD95,000,000.

   Build in one year:

   PV(Delay) = USD20,965,812

$$= \frac{0.7 \times (138,000,000 - 102,600,000 - 250,000) + 0.3 \times (-250,000)}{1.17}.$$

The investor should therefore delay the project given the higher present value.

QUESTION SET

1. Alyssa Tan at Asiastruct has identified three property transactions in Thailand from the past two years comparable to the original 1.26 million ft^2 project (with 900 residential units averaging 1,400 ft^2 each) located in Bangkok from earlier in the learning module. Tan evaluated each property's key features, including their relative location, age, and size, which she combined in order to establish an expected net difference in price per ft^2. Selected data from these three properties and the new Bangkok project are summarized below.

Data/project	Bangkok	Comp 1	Comp 2	Comp 3
Gross square feet	1,260,000	1,000,000	1,400,000	1,100,000
Price per ft^2		THB 50.24	THB 61.58	THB 44.76
Location adjustment		–4%	+2%	9%
Age adjustment		–2%	+2%	0%
Size adjustment		–2%	+1%	–1%
Net difference		–8%	5%	8%

If the Bangkok project cost is THB54,000,000 today and the value derived from this sales comparison is used as a basis for the expected price of the development upon completion in two years, determine whether the project is likely to exceed Asiastruct's 10% hurdle rate.

Solution:

First, solve for the average adjusted price per ft^2 of the three properties:

Adjusted price per ft^2: Comp 1: THB46.22 = THB50.24 × (1 – 0.08).

Comp 2: THB64.66 = THB61.58 × (1 + 0.05).

Comp 3: THB48.34 = THB44.76 × (1 + 0.08).

Average adjusted price: THB53.07 = (46.22 + 64.66 + 48.34)/3.

Next, solve for the Bangkok property value upon completion in two years by multiplying the square footage by the average adjusted price:

THB66,872,652 = 1,260,000 ft^2 × THB53.07/ft^2.

Finally, calculate the return for an initial cash outflow equal to today's project cost and an inflow equal to the estimated property value in two years. We may use either the Excel PMT function or a discounted cash flow approach to solve for an IRR of 11.28%:

IRR = 11.28% [=IRR(-54000000,0,66872652)], or

$$FV = PV(1+r)^t;\ r = \left(\frac{FV}{PV}\right)^{\frac{1}{t}} - 1\ ;$$

$$11.28\% = \left(\frac{66,872,652}{54,000,000}\right)^{\frac{1}{2}} - 1.$$

The 11.28% estimated return exceeds the analyst's 10% hurdle rate.

2. Alyssa Tan is considering a scenario analysis to build on her earlier analysis of the Bangkok project. Her NOI forecast of THB 6,093,360 for the first full year of operation (Year 3) is the base case, and her oversupply scenario of a 10% fall in rents and vacancies and a 2% rise in operating costs, yielding an NOI of THB4,422,600, is the downside case. Tan adds a growth scenario in which a local shortage of rental housing results in 10% upside to rental rates, lower vacancies, and lower operating costs, resulting in Year 3 NOI of THB7,151,344. These three scenarios and their associated probabilities are summarized below:

Scenario	Probability	Year 3 NOI (THB)
Growth Scenario	25%	7,151,344
Base-Case Scenario	45%	6,093,360
Oversupply Scenario	30%	4,422,600

Assuming a direct capitalization approach with a 10% cap rate, determine whether the Bangkok project meets her 10% hurdle rate using scenario analysis and assuming the same initial investment of THB54,000,000.

Solution:

Use the same approach as in Equation 11 to solve for the expected NOI given the three scenarios and their associated probabilities:

$$\text{NOI} = \sum_{i=1}^{n} \text{Probability}(i) \times \text{NOI}_i.$$

$$\text{NOI} = \text{THB}5,856,628$$
$$= (0.45 \times 6,093,360) + (0.30 \times 4,422,600) + (0.25 \times 7,151,344).$$

Use Equation 3 to solve for the expected property value upon completion:

$$\text{Property value} = \frac{\text{Expected NOI}}{\text{Capitalization rate}}.$$

$$\text{THB}58,566,281 = \frac{5,856,628}{0.10}.$$

Note that this is the expected property value at the end of Year 2. Similar to Question 1, we may calculate the return using an initial cash outflow equal to today's project cost of THB54,000,000 and an inflow equal to THB58,566,281. Using the Excel PMT function or a discounted cash flow approach, we solve for an IRR of 4.14%:

IRR = 4.14% [=*IRR*(-54000000,0,58566281)], or

$$\text{FV} = \text{PV}(1+r)^t;\ r = \left(\frac{\text{FV}}{\text{PV}}\right)^{\frac{1}{t}} - 1\ ;$$

$$4.14\% = \left(\frac{58,566,281}{54,000,000}\right)^{\frac{1}{2}} - 1.$$

The 4.14% estimated return is below the analyst's 10% hurdle rate, and she should therefore not pursue the project based on scenario analysis.

3. As Asiastruct considers its alternatives, Alyssa Tan is exploring the Bangkok project today versus a one-year delay in construction. After considering all value estimates from earlier exercises, she decides on an appropriate future estimate of the property value upon completion. She notes the present value of the completed project at her 10% hurdle rate is THB59,090,909. The present value of construction costs if the project is initiated today is THB54,000,000. Tan has established two possible market scenarios if construction is delayed by one year:

   Growth scenario (60% probability): Construction costs rise by 12%, while the completed project value increases by 16%.

   Stable scenario (40% probability): Construction costs rise 3%, while the completed project value increases by 1%.

   Justify Tan's recommendation on whether Asiastruct should build the Bangkok project now, delay for a year, or not pursue the project at all.

   Solution:

   The justification for a recommendation to build now or delay is best conducted using an NPV analysis based on expected probabilities and using a discount rate equal to Asiastruct's hurdle rate.

   First, we evaluate whether to build the project now by comparing project costs to value upon completion in PV terms:

   PV of project construction cost: THB54,000,000

   PV of project upon completion: THB59,090,909

   Project NPV: THB5,090,909 = 59,090,909 – 54,000,000.

   Asiastruct would pursue the project today given its positive NPV of THB5,090,909, which we now compare to a one-year delay.

   Next, we evaluate the estimated return given a project delay by comparing construction costs to value upon completion under both scenarios weighted by probability as of the time the project starts in one year.

   Growth scenario (60% probability):

   Construction costs in one year: THB60,480,000 = 54,000,000 × 1.12.

   Project value in one year: THB68,545,455 = 59,090,909 × 1.16.

   Difference between project value and construction costs in one year: THB8,065,455 = 68,545,455 – 60,480,000.

   Stable scenario (40% probability):

   Construction costs in one year: THB55,620,000 = 54,000,000 × 1.03.

   Project value in one year: THB59,681,818 = 59,090,909 × 1.01.

   Difference between project value and construction costs in one year: THB4,061,818 = 59,681,818 – 55,620,000.

   Use probability weights to estimate the project's value in one year:

   Project value: THB6,464,000 = (8,065,454 × 0.6) + (4,061,818 × 0.4).

   Discount project value by the hurdle rate to compare to today's land price:

$$\text{THB}5,876,363 = \frac{\text{THB}6,464,000}{(1+0.10)^1}.$$

Since the delayed project's PV of THB5,876,363 exceeds that of pursuing the project today when discounted by Asiastruct's hurdle rate, Tan should recommend delaying construction by one year.

TIMBERLAND AND FARMLAND INVESTMENT CHARACTERISTICS

5

- ☐ discuss the distinctive investment characteristics of timberland and farmland

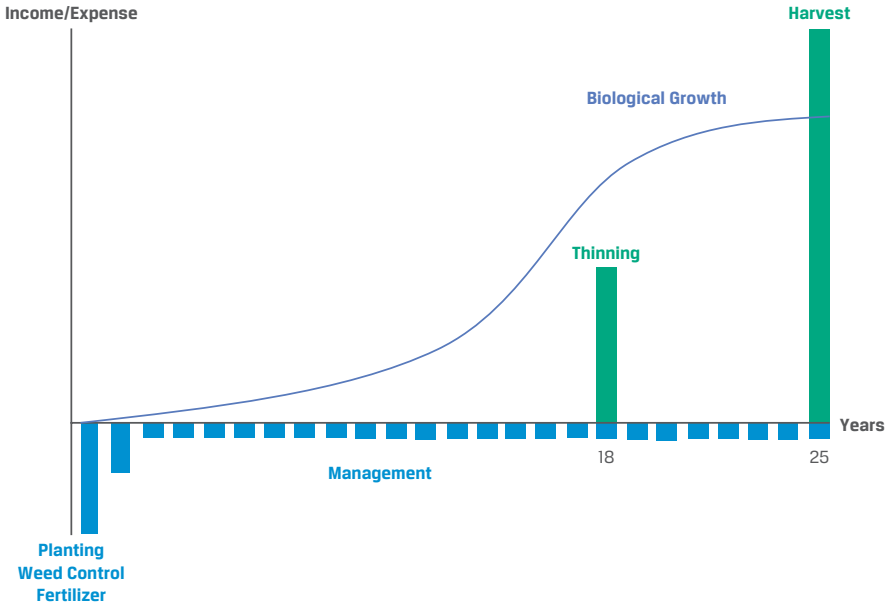
Timberland Investment Characteristics

Private timberland investment began as a shift in ownership from private forest product companies in the United States seeking greater tax and capital efficiency to tax-exempt pensions and other investors seeking portfolio diversification. While most private investable timberland is in the United States, these investments have expanded to regions including Central and Eastern Europe, Latin America, Australia, and New Zealand.

As in the case of other types of real estate, timberland derives its value from current and future economic use. Timberland use involves the biological growth and harvest of timber naturally grown or cultivated and managed on forest plantations for use in the paper, packaging, and construction industries. The suitability of land for timber production varies by climate, soil type, and the age, species, and density of existing tree cover. Thinned or harvested timber is logged by private firms, which pay a **stumpage fee** to timberland owners for the right to harvest. These logs are then transported and processed or milled and kiln dried for further use or sale at market prices that vary based on quality and potential end uses. **Pulpwood** consisting of lower-quality, small, and often thinned trees is the primary input for paper products, while higher-priced **sawtimber** is top-quality timber used for construction lumber and other building products, such as plywood and particleboard. Unharvested timber appreciates in value over time not only due to growth but also since a higher proportion of many older trees may be sold as sawtimber.

Given a harvest cycle that can span 25–100 years, timberland is usually evaluated based on a long-term investment horizon that combines income and capital appreciation. Exhibit 10 shows the cash flows associated with a simple timber growth and harvest cycle, as in the following case.

Exhibit 10: Timber Growth and Harvest Cycle Cash Flows



KNOWLEDGE CHECK: PINE PLAINS LLC TIMBER MANAGEMENT PLAN

Pine Plains LLC (PPLLC) is a private investment firm that owns a several thousand–acre pine plantation in the southern United States. PPLLC's 25-year timber rotation plan calls for the reforestation of recently harvested bare land, with thinning planned in 18 years and final harvest in 25 years. PPLLC forestry management establishes the following per-acre estimates of expected revenue and expenses:

Year	Description	USD per acre
Expenses:		
Annual (1–25)	Management fee	4.00
0	Site preparation and planting	500.00
1	Weed control and fertilizer	75.00
Revenues:		
18	Thinning revenue	725.00
25	Final harvest revenue	5,750.00

1. Assuming a 6.5% annual required rate of return, calculate the net present value of PPLLC's timber rotation plan.

Solution:

Recall from earlier time-value-of-money lessons that a single cash flow in n periods may be discounted to the present as follows:

$$\text{PV(Cash flow)} = \frac{\text{Cash flow}}{(1+r)^n},$$

where r is the required rate of return and n is the number of periods, and the present value of a series of fixed cash flows is calculated as

$$\text{PV(Series of fixed cash flows)} = \sum_{i=1}^{n} \frac{\text{Cash flow}}{(1+r)^i}.$$

Using r of 6.5%, we can calculate the PV of PPLLC's timber rotation as follows:

Year	Description	USD per acre	PV USD per acre
Annual (1–25)	Management fee	(4.00)	(48.79)
0	Site preparation and planting	(500.00)	(500.00)
1	Weed control and fertilizer	(75.00)	(70.42)
18	Thinning revenue	725.00	233.37
25	Final harvest revenue	5,750.00	1,191.04
	PV of timber rotation plan		USD805.20

Similar to NOI for a developed property, the present value in the prior example represents the return of a timber rotation through final harvest over 25 years. We can calculate the net future value (NFV) of the rotation per acre at the end of the 25-year period to be USD3,887.26:

$$\text{NFV} = \text{USD3,887.26} = \text{USD805.20} \times (1.065)^{25}.$$

If an acre of land remains in rotation indefinitely with constant costs and revenues, we would expect to earn NFV of USD3,887.26 at the end of each 25-year cycle in perpetuity. Since income is realized over a multiyear cycle rather than annually, we approach timberland valuation differently from other real estate assets by solving for the so-called **land expectation value** (LEV), or the value of an acre of bare land in perpetual timberland production, using the discounting formula for a perpetual periodic annuity, as follows:

$$\text{LEV} = \frac{\text{NFV}}{(1+r)^t - 1}, \tag{13}$$

where

NFV = Net future value of a single timber rotation

r = Required rate of return

t = Length of timber rotation in years

For example, we may solve for LEV in the case of Pine Plains LLC as follows:

$$\text{LEV} = \text{USD1,015.56} = \frac{\text{USD3,887.26}}{(1.065)^{25} - 1}.$$

While LEV provides a valuation based solely on timber rotation cash flows under simple assumptions, in practice, additional factors, such as potential alternative land use or premiums paid by investors to capture carbon credits, may significantly affect timberland prices. As a result, the discounted cash flow approach is often complemented by sales comparisons when similar recent transactions exist.

The unique characteristics of timberland investments may be traced to their biological features. For example, cash flows derived from the harvest and sale of real assets used as inputs in basic industries offer inflation-hedging potential and tend to

have low correlations with other asset classes. Forest management techniques may be employed to optimize age distribution of trees, the stocking of species, and the acceleration or deferral of harvests in response to market price changes at little or no cost. Environmental conservation efforts and other constraints on available global timberland supply combined with growing demand for pulp and wood products form the basis for continued demand. Timberland has favorable cyclical characteristics, because growing trees appreciate regardless of economic conditions and the real estate cycle and serve as a long-term inflation hedge as a real asset. Although thinning serves as a form of forest management, timberland owners face biophysical risks from drought, wildfires, pests, and disease. Beyond its attractive risk and return features, investor interest in timberland has also increased due to its environmental, social, and governance–related characteristics. A secondary source of timberland returns is the purchase of forests or carbon credits from forest owners as a form of **carbon offset**. Carbon offsets are investments that reduce or remove carbon dioxide and other greenhouse gases to compensate for emissions produced elsewhere to achieve reduction or net-zero emission goals.

TIMBERLAND INVESTMENTS AS A CARBON OFFSET

While timberland returns are primarily based on the harvest of trees over the growth cycle, the market for carbon offsets has increased financial incentives for timberland owners to leave their trees standing. As government mandates for carbon offsets through cap-and-trade systems continue to develop, many issuers and investors have initiated voluntary carbon offsets to achieve emission reduction targets. For example, carbon emitters such as oil and gas companies are eager to purchase voluntary offsets, while timberland owners may sell these credits in exchange for allowing continued growth in uncut timber.

New market entrants seeking to match buyers and sellers of carbon credits have developed sophisticated approaches to quantifying the carbon benefits of harvest deferral. For example, Natural Capital Exchange (NCX) in the United States combines satellite images with field measurements to establish the size and species of trees in each acre of forest using Microsoft's AI for Earth. Once a property assessment is completed, timberland owners may submit offers to NCX on the number and price of carbon credits they are willing to sell for one year and, once accepted by a bidder, receive compensation following verification of harvest deferral at the end of the year.

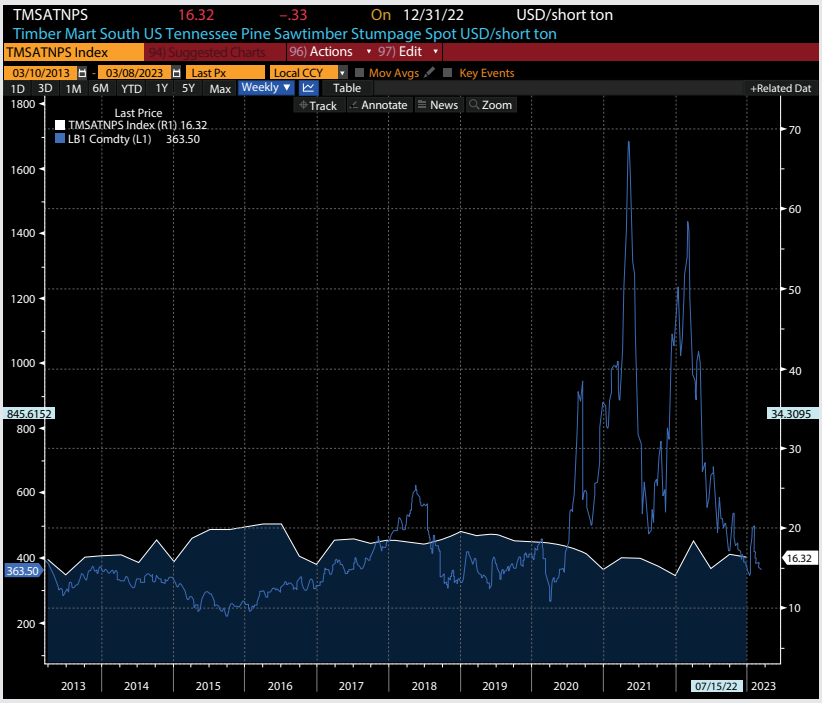
Timberland investors face a high degree of illiquidity and must therefore consider these investments as components of a long-term portfolio. The length of the timber growth and harvest cycle and the processing and delivery cycle used to convert raw timber into pulp, paper, and lumber dampen the effect of short-term market fluctuations for finished products. For example, rising market prices for pulpwood and sawtimber may not always be reflected in higher stumpage prices for landowners, as shown in the following example.

SUPPLY FACTORS AND LUMBER PRICES DURING THE COVID-19 PANDEMIC

An earlier example illustrated the sharp rise in US lumber prices during the COVID-19 pandemic. In addition to continued strong demand for lumber in the construction industry due to continued low interest rates and increases in home renovations and new residential building, supply chain issues unique to COVID-19, including a shortage of truck drivers, declining mill capacity caused by worker shortages, and increased safety protocols, were cited as causes for the spike in lumber prices.

Timberland owners, in contrast, receive stumpage prices upon harvest, which have remained largely stable over time and are far less volatile than the final product, which includes labor, transportation, and other processing costs, as shown in Exhibit 11. The exhibit shows stumpage spot and lumber futures prices from 2013 to 2023.

Exhibit 11: US Stumpage Spot Prices vs. Lumber Futures Prices, 2013–2023



Source: Bloomberg.

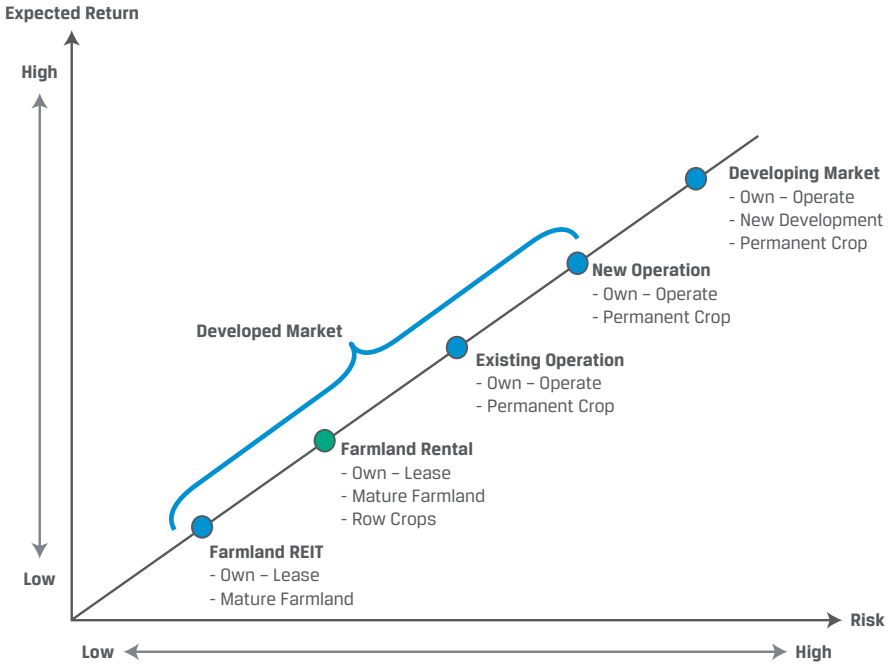
The relatively stable Timber Mart South Tennessee Pine Sawtimber Stumpage spot price (TMSATNPS Index) is the US dollar price per ton as shown on the right axis, while the more volatile front-month lumber futures price ("LB1 Comdty") is shown on the left axis in US dollars per 110,000 board feet of random length lumber.

Farmland Investment Characteristics

In contrast to private timberland historically held by forest product companies, traditional farm ownership varies widely across regions, ranging from often smaller, family-owned and -operated farming enterprises in the United States to larger-scale, concentrated agricultural land ownership in such countries as Brazil or state-owned land in developing countries in Africa and Southeast Asia. In contrast to timberland, farmland investments may be of smaller size—perhaps tens or a few hundred acres or hectares. For example, 98% of US farmland is owned by families, excluding corporations, cooperatives, and external managers, and it remains a key source of global family wealth.

While institutional farmland investment has a history similar to that of timberland, with large US investors seeking portfolio diversification, the greater variety of agricultural products and operating models gives rise to a broader investment risk-versus-return spectrum, as shown in Exhibit 12.

Exhibit 12: Farmland Investment Risk/Return Spectrum



Similar to other forms of real estate, farmland derives its value from current and future economic use. The suitability of land for agricultural production varies widely based on temperature, soil type, rainfall, and available irrigation sources. A shorter growth cycle is measured in seasons for **row crops**, or those harvested annually and rotated, and in years for **permanent crops** planted for many seasons, such as orchards or vineyards, which typically generate a higher return per acre or hectare. Crops are used either directly as a raw material in food production or as an intermediate good when **feed crops**, such as grains, are cultivated for use in raising livestock.

A key distinction in farmland investment is the difference between **own–operate** approach and the **own–lease** approach to farmland ownership. The owner–operator model involves owning land, buildings, equipment, and other assets and operating an agricultural business. Under the own–lease model, far more common among financial investors, an owner or lessor receives fixed rental payments for undeveloped tillable acreage under a multiyear lease agreement from a farm operator lessee who assumes all other business risks. Owner-operated farms and agricultural businesses have cash flow features and risk–return characteristics similar to those of private companies addressed earlier in the curriculum, while own–lease farmland investments earn periodic rent, which offsets property tax, with no other significant income or expenses. As a result, financial returns on own–lease farmland are primarily in the form of capital appreciation instead of income.

The shift to private investable farmland began among tax-exempt pensions and other investors for several reasons, including

- portfolio diversification,
- long-term capital appreciation,
- an inflation hedge, and
- a relative lack of correlation with the economic cycle.

Steady and growing demand for food and other plant- and animal-based raw materials combined with government policies ensure stable demand for agricultural land use. Examples of government intervention in agriculture include production supports, subsidies, and other programs under the Common Agricultural Policy of the European Union, as well as US Renewable Fuel Standards mandating and subsidizing the production of biofuels from corn and other plants, which represents 10% of the country's gasoline supply. While farmland generally lacks the degree of carbon capture available from timberland, opportunities to reduce carbon emissions include environmental protection via expanded conservation areas; sustainable farming practices, such as reduced tillage; and soil and water protection.

Unlike other vacant land, farmland generates positive cash flow in the form of land leases less taxes with no capital improvements necessary, while also granting an owner a perpetual option to develop the property for an alternative economic use in the future. In addition to the inflation-hedging properties of tillable land whose economic use is based on the value of real assets, such as crops, the option to rezone and repurpose a property may be particularly valuable if land prices are volatile or the property is subject to increasing urban density or greater proximity to transportation infrastructure.

QUESTION SET

1. DugFir LLC is a private investor in timberland throughout the western United States. The firm intends to spend USD400 per acre today for site preparation and planting and an additional USD90 per acre on weed control and fertilizer in one year and expects thinning revenue of USD500 per acre in 15 years and harvest revenue of USD7,000 per acre in 25 years. Its annual management fee is USD3 per acre. Which of the following is closest to the correct land expectation value per acre (LEV) of this proposed timberland development assuming an 8% required return?

   A. USD664

   B. USD778

   C. USD815

   Solution:

   The correct response is B. The present value of the rotation plan is USD664.39 and may be calculated as the sum of its components, shown and summarized in the table that appears later in this solution.

   We can solve for the present value of the annual USD3.00 management fee as –32.02 in several ways—namely, as the PV of a series of cash flows:

   $$\text{PV(Series of fixed cash flows)} = \sum_{i=1}^{n} \frac{\text{Cash Flow}}{(1+r)^i} = \sum_{i=1}^{25} \frac{\text{USD3.00}}{(1+0.08)^{25}}.$$

   We can also use the same annuity calculation used for mortgage payments earlier by solving for the principal:

   $$A = \frac{r \times \text{Principal}}{1-(1+r)^{-n}}; \text{USD3.00} = \frac{0.08 \times \text{Principal}}{1-(1+0.08)^{-25}}.$$

   Or we can use the Excel PV function [=PV(*rate,nper,pmt,[fv],[type]*)], or PV(0.08,25,3,0,0).

   All other fees and returns are single-period PV calculations:

   $$\text{Weed control and fertilizer costs: (USD83.33)} = \frac{(\text{USD90})}{1.08}.$$

Thinning revenue: $\text{USD}157.62 = \frac{\text{USD}500}{(1.08)^{15}}$.

Final harvest revenue: $\text{USD}1,022.13 = \frac{\text{USD}7,000}{(1.08)^{25}}$.

Year	Description	Cost/return per acre	PV USD per acre
Annual (1–25)	Management fee	(3.00)	(32.02)
0	Site preparation and planting	(400.00)	(400.00)
1	Weed control and fertilizer	(90.00)	(83.33)
15	Thinning revenue	500.00	157.62
25	Final harvest revenue	7,000.00	1,022.13
	PV of timber rotation plan		USD664.39

Solve for the land expectation value by first calculating the net future value in the numerator of Equation 9 as follows:

$$\text{LEV} = \frac{\text{NFV}}{(1+r)^t - 1}.$$

The NFV of USD664.39 at the end of 25 years is equal to USD4,550.05 [= USD664.39 × $(1.08)^{25}$]. Dividing this amount by $(1.08)^{25} - 1$ yields an LEV result of USD777.99.

2. Which of the following valuation approaches is unlikely to apply to timberland?

   A. Sales comparison approach

   B. Cost approach

   C. Discounted cash flow approach

   Solution:

   The correct response is B. Unlike developed real estate, the asset (timber) cannot be bought and constructed; thus, the cost approach does not apply to timberland. Both the sales comparison and discounted cash flow approaches are typically used for valuing timberland, so responses A and C are incorrect.

3. Explain why short-term fluctuations in finished wood products, such as lumber, may not translate into similar fluctuations in stumpage fees.

   Solution:

   The length of the timber growth and harvest cycle and the processing and delivery cycle used to convert raw timber into pulp, paper, and lumber dampen the effect of short-term market fluctuations for finished products on stumpage fees. As an example, the sawtimber must be processed at a mill and then transported to a building site. If labor costs rise considerably, due to shortages of skilled labor for staffing mills and driving trucks, the price of lumber may increase significantly while stumpage fees for the sawtimber remain stable.

PRIVATE REAL ESTATE RISK AND RETURN

6

- ☐ discuss the risk and return among private real estate investments and as compared to other investments as part of a strategic asset allocation

Real estate investments were characterized in earlier learning modules as a source of diversification from public fixed-income and equity securities, a hedge against inflation as a real asset, and a source of cash flows and enhanced return due to their illiquid nature. While largely public and private core and core-plus investments consist of income-producing properties, value-add and opportunistic real estate returns primarily involve capital appreciation by increasing value through the upgrade of a property's economic use or creation of new capacity.

Institutional investors—such as pensions and sovereign wealth funds—and ultra-high-net-worth individuals or family offices are usually best suited to accommodate the larger investment sizes, lack of liquidity, and longer and less certain time horizons associated with private real estate. These investors align their allocation to such investments with their risk tolerance, return objectives, and market expectations, as demonstrated in the following case study.

CASE STUDY

XGT's Real Estate Investment Strategy

XGT, a large developed-market public pension plan, has the following investment policy for real assets, including real estate by segment:

Real Assets: Real Estate 15% (± 3%)

Inflation Sensitive 5% (± 3%)

Suballocation (Real Estate): Core 60% (± 5%)

Value-Add 20% (± 5%)

Opportunistic 20% (± 5%)

Benchmark and Restrictions

The portfolio benchmark is the NCREIF Open End Diversified Core Equity (ODCE) index net of fees. Portfolio allocations seek a long-term return in excess of the benchmark while remaining within target ranges.

Core Real Estate

Core investments include stable, well-diversified, income-producing properties in developed markets expected to produce a return net of fees of 7% per annum. Core portfolio leverage is limited to 40% of total asset value.

Value-Add Real Estate

Value-add investments include repositioned, renovated, or redeveloped properties with expected risk and return that exceed the expected risk and return of core real estate. These investments are expected to have limited income and greater capital appreciation, with expected return net of fees of 8% per annum. Value-add portfolio leverage is limited to 60% of total asset value.

Opportunistic Real Estate

Opportunistic real estate investments focus on development, extensive redevelopment, and land development and may include international or emerging markets. Opportunistic investments are expected to return 10% per annum net of fees, with portfolio diversification and leverage to be vetted individually in the due diligence process.

XGT's Investment Committee is considering changes to its allocation between value-add and opportunistic segments given expected distributions over the next six months. Following an extended period of low borrowing costs, rising rents, and new construction growth, XGT's investment consultant forecasts higher interest rates and an economic slowdown in the next 12–24 months.

1. Discuss XGT's decision between increasing value-add or opportunistic portfolio allocations in light of the consultant's economic forecast.

   Solution:

   Value-add and opportunistic investments entail the greater risk and return of upgrading or changing a property's economic use, which also involves higher leverage compared to core real estate. Under the consultant's forecast scenario, higher rates and a pending real estate market slowdown increase debt financing costs and required cap rates and reduce the income-producing potential of properties once completed. While value-add projects usually involve property redevelopment with existing current income and shorter development periods, opportunistic real estate investments typically involve initial negative income with greater leverage and the highest project risk as a project nears completion, magnifying the importance of real estate cycle timing as an economic value driver. This suggests that an increased allocation to value-add as opposed to opportunistic real estate is warranted under this scenario.

The prior case study illustrates the risk-versus-return trade-off across various real estate investments and over the property development life cycle.

General partners seek to construct an optimally diversified asset portfolio of value-add or opportunistic assets across different geographies, asset types, and expected cash flow timing designed to maximize the likelihood of achieving investor hurdle rates or preferred rates of return. Investors comparing the risk and return among private real estate investments to other private market opportunities typically focus on expected IRR, as shown earlier, or a simpler **multiple of invested capital** (MOIC), or money multiple, on total invested capital (or paid-in capital). This calculation ignores the timing of cash inflows and outflows, is typically calculated on a gross basis ignoring fees, and simply compares the total value of all realized investments and residual asset values (assets that may still be awaiting sale) relative to capital invested:

$$\text{MOIC} = (\text{Realized value of investment} + \text{Unrealized value of investment})/\text{Total invested capital.} \tag{14}$$

These return metrics are used to compare private real estate to other private investments, portfolio benchmarks, or target returns, as illustrated in the following case study.

CASE STUDY

XGT's Kingston Tower Investment

XGT's Investment Committee decides to increase its value-add private real estate allocation following the recommendation of its consultant, choosing an LP investment that includes the Kingston Tower project described earlier, an office tower conversion into apartments and coworking space. The GP investor expects the following cash flows during renovation and upon completion:

- Year 1: Assume NOI_1 of CAD2,200,000.
- Year 2: Renovation costs exceed NOI_2, net cash flow of –CAD2,000,000.
- Year 3: Renovation costs exceed NOI_3, net cash flow of –CAD2,000,000.
- Year 4: Stabilized base-case NOI_4 of CAD6,412,500 at 95% occupancy.

The GP plans to sell Kingston Tower at the end of three years at an expected property value of CAD37,720,588 assuming a 17% cap rate:

$$\text{Property value} = \frac{\text{Expected NOI}_4}{\text{Capitalization rate}}.$$

$$\text{CAD}37,720,588 = \frac{\text{CAD}6,412,500}{0.17}.$$

GP fees include a 1% annual management fee plus a 20% performance fee determined at the end of the holding period based on property appreciation if the investment return after management fees exceeds a 10% hurdle rate. For purposes of this example, assume that Kingston Tower is purchased for CAD20,000,000 in Year 0 and the investment is financed by equity, with no further transaction costs.

1. Solve for XGT's base-case MOIC.

   Solution:

   Solve for MOIC using Equation 10:

   MOIC = (Realized value of investment + Unrealized value of investment)/Total invested capital.

   Given the expected sale of Kingston Tower at the end of Year 3, unrealized investment value is zero, with the MOIC equal to the sum of cash inflows divided by cash outflows, as follows:

   Cash inflows: NOI_1 + (Expected property value)4

   Cash outflows: (Purchase price)0 + NOI2 + NOI3

   $$\text{MOIC} = 1.663 = \frac{2,200,000 + 37,720,588}{20,000,000 + 2,000,000 + 2,000,000}.$$

2. Calculate XGT's base-case IRR both before and after fees.

   Solution:

   Using the Excel IRR function [=IRR(*values,guess*)] as shown earlier and the cash flows in the following table,

Year 0	Year 1	Year 2	Year 3
(20,000,000)	2,200,000	(2,000,000)	35,720,588

we can solve for IRR *before* fees, equal to 22.28%:

22.28% = IRR(-20000000,2200000,-2000000,35720588).

To solve for IRR *after* fees, we incorporate both the 1% annual management fee and the 20% performance fee to obtain net cash flows, as follows.

Year	Year 0	Year 1	Year 2	Year 3
Gross	(20,000,000)	2,200,000	(2,000,000)	35,720,588
1% Mgmt. Fee		(200,000)	(200,000)	(200,000)
20% Perf. Fee				(3,544,118)
Net Cash Flow	(20,000,000)	2,000,000	(2,200,000)	31,976,470

The 20% performance fee is CAD3,544,118, or 0.2 × (37,720,588 – 20,000,000).

We can solve for IRR *after* fees, equal to 17.14%:

17.14% = IRR(-20000000,2000000,-2200000,31976471).

3. Determine the breakeven Kingston Tower property value required at the end of Year 3 in order for XGT to meet the return requirements as stated in its value-add real estate investment policy.

Solution:

Recall from XGT's investment policy that value-add real estate is expected to earn a return of 8% per annum net of fees. We must therefore solve for an expected property value at the end of Year 3 that gives us an IRR *after* fees of 8%. Note that since the 8% IRR falls below the 10% hurdle rate required for the 20% performance fee to apply, the GP will earn only the 1% management fee. We therefore must solve for the gross cash flow in Year 3 given an 8% IRR after fees, as shown in the following table:

Year	Year 0	Year 1	Year 2	Year 3
Gross	(20,000,000)	2,200,000	(2,000,000)	? + (2,000,000)
1% Mgmt. Fee		(200,000)	(200,000)	(200,000)
Net Cash Flow	(20,000,000)	2,000,000	(2,200,000)	? + (2,200,000)

As shown previously, we can use the Excel IRR function, entering an estimated value for Year 3 net cash flow [= $(\text{Expected property value})_3$ – 2,200,000) and solving for IRR, and then use the Goal Seek function to iterate a new solution for the Year 3 net cash flow for which the IRR of all net cash flows is 8%.

For example, assume that the property may be sold at the end of Year 4 for CAD28,200,000 with a Year 3 net cash flow of CAD26,000,000. Solve for IRR:

9.11% = IRR(-20000000,2000000,-2200000,-2600000).

Using Goal Seek to solve for an IRR of 8% by changing Year 3 net cash flow, we arrive at a Year 3 net cash flow of CAD25,248,590. Given that this includes the expected property value and NOI_3 of –CAD2,000,000 and CAD200,000 in management fees, we can solve for an expected property value of CAD27,448,590, or CAD25,248,000 + CAD2,200,000.

4. Interpret the breakeven property value from Question 3 in the context of the investment consultant's forecast, the earlier scenario analysis, and the sensitivity analysis in Exhibit 8.

Solution:

Based on project assumptions including Kingston Tower's expected purchase price, renovation costs, and cash flow, including the capitalization rate used to solve for the future sale price based on stabilized Year 4 NOI, XGT is expected to reach its target 8% return after fees if the property can be sold for at least CAD27,448,590 at the end of three years.

Given the investment consultant's forecast of a likely economic downturn, it makes sense to consider this expected property value in the context of the downside case established earlier by the LP analyst, under which it was assumed that coworking space rent would equal just CAD45 per ft^2 and residential rent would equal CAD50 per ft^2 in Year 4. However, the expected IRR from the earlier calculation is not directly comparable given the assumed higher purchase price and the absence of fees. Instead, we may consider the property value sensitivity analysis in Exhibit 8 based on different coworking and residential rental rates, which shows an expected property value at the end of Year 3 of CAD25,955,882 based on these downside-case assumptions. This suggests that XGT will fail to reach its minimum 8% return after fees under the downside case proposed by the analyst. We may confirm this by recalculating IRR after fees using the lower sale price of CAD25,955,882 at the end of three years and deducting –CAD2,000,000 Year 3 NOI and the CAD200,000 management fee for a Year 3 net cash flow of CAD23,755,882:

5.77% = IRR(-20000000,2000000,-2200000,23755882).

This example and those that precede it demonstrate the application of valuation tools along with scenario and sensitivity analysis used by financial analysts in practice to thoroughly evaluate the expected risk and return of these investments. When carefully and consistently applied in the context of investment policies and market analysis, private real estate investments can play an important role in meeting investor objectives and goals.

QUESTION SET

1. Which of the following real estate classifications is likely to have the highest return expectation?

   A. Value-add real estate

   B. Opportunistic real estate

   C. Core real estate

Solution:

The correct response is B. Opportunistic real estate, because of its focus on initial development of properties, carries the highest levels of risk in private real estate investing. Its returns are focused on the capital appreciation of the project during its development phase. Value-add real estate is riskier than core real estate; however, value-add projects are less likely to be in the development cycle for as long as opportunistic ones. Core real estate includes established income-producing properties and, as such, carries the lowest risk and return expectations among the major real estate categories.

The following information relates to Questions 2 and 3.

Alyssa Tan at Asiastruct approaches the Bangkok residential project analysis in earlier question sets from a different perspective, using the following simplified details:

Assume the property requires an investment of THB54,000,000 over the two years of property development and construction. Asiastruct contributes THB24,000,000 initially and an additional THB30,000,000 at the beginning of the second year. At the beginning of the third year, the property begins operations, with NOI of THB6,093,360 during the third year. Asiastruct is planning to sell the property upon its opening at the beginning of the third year, assuming a cap rate of 10%. Given that this project is an opportunistic investment, Asiastruct has return expectations of 10% net of fees.

2. Calculate the real estate investor's MOIC and IRR, and discuss the associated implications for Asiastruct as a result of these calculations.

Solution:

First, use the third-year NOI and the cap rate to compute an expected selling price of the property of THB60,933,600 at the end of the second year. The cash flows are as follows:

Year	0	1	2
Cash flows (THB)	(24,000,000.00)	(30,000,000.00)	60,933,600.00

MOIC = 60,933,600/54,000,000 = 1.13.

IRR can be calculated using the IRR function in Excel to arrive at IRR of 8.66%. Without comparable property MOICs to use for comparison purposes, it is impossible to assess the relative attractiveness of the MOIC of 1.13.

The IRR provides a better comparison because this measurement accounts for the timing of cash flows and can be compared more directly to return requirements. Given that the investor expects a 10% return on opportunistic real estate investments net of fees, it is clear that the 8.66% IRR (before fees) makes the Bangkok project economically unattractive.

3. Analyze how much improvement would be necessary in the Bangkok project's NOI to reach a 10% IRR (before fees).

Solution:

While this analysis may be solved by trial and error, the Goal Seek function in Excel allows for a quick solution methodology. The set cell is the one in which the IRR function is solved. Set the desired value to 10.00%, and allow the project NOI to change. If the Bangkok project NOI can be improved to THB6,203,806, then the 10% return can be met (ignoring fees). This is a 1.81% improvement in NOI, and the investor would need to assess the feasibility of such an increase.

PRACTICE PROBLEMS

The following information relates to questions 1-5

Northern States, a US multi-employer pension plan with USD80 billion in assets, has the following investment policy for real assets, including real estate by segment:

Real Assets: Real Estate 15% (± 3%)

Inflation Sensitive 5% (± 3%)

Suballocation (Real Estate): Core 60% (± 5%)

Value-Add 20% (± 5%)

Opportunistic 20% (± 5%)

Northern States' investment committee is discussing its planned real estate and real assets portfolio weights for the coming year.

The consensus view of committee members regarding the economy and the market for residential housing is summarized by the following two statements:

Statement 1	The US national economy is currently in or nearing a recession.
Statement 2	The lack of residential housing supply is a major concern for US adults.

The discussion shifted to Northern States' suballocations within real estate. Given the committee's expectations of a recession, they decided to maintain the current weight on core real estate while calling for a vote to re-allocate between value-add and opportunistic real estate.

The conversation turned to the due diligence process involved in opportunistic projects. The pension plan participates in all its private real estate investments as an LP. The investment committee's risk guidelines for participation as an LP include strict covenants regarding LTV and DSC for the GPs of all private real estate investments. The committee members discussed whether they should consider changes to the LTV and DSC guidelines in light of the economic climate.

Committee members also discussed the valuation environment in private real estate. Due to the residential housing supply situation, properties that were typically selling at high prices (based on price per square foot) using sales comparison valuation approaches tended to produce high valuations, while valuations of the same properties using direct capitalization approaches tended to produce lower value estimates.

The final discussion topic of the investment committee involves the pension plan's investments in timberland. Recently, lumber prices had become quite volatile, and some members of the committee suggested that they would prefer to reduce the plan's exposure to timberland investments as a result.

1. Which two phases of the real estate cycle are most likely reflected by Statements 1 and 2?

   A. Oversupply and recession

   B. Recession and recovery

C. Recession and expansion

2. Contrast the relative risks of private value-add versus opportunistic real estate suballocations faced by Northern States given its market view.

3. Which of the following would be the most appropriate changes to Northern States' LTV and DSC risk guidelines in the current economic climate?

   A. Increase LTV and decrease DSC benchmarks.

   B. Decrease LTV and increase DSC benchmarks.

   C. Increase LTV and increase DSC benchmarks.

4. Which of the following is the most likely argument for the discrepancy between the sales comparison and direct capitalization valuation approaches?

   A. Direct capitalization approach cap rates are currently too low.

   B. Rental revenues are strong in most housing markets around the country.

   C. The residential housing supply is temporarily too low.

5. Provide a counterargument to the statement made by committee members regarding the volatility of lumber prices and its effect on timber investments.

The following information relates to questions 6-9

BFW Invest Considers an Opportunistic Project

Sylvia Steinhaeuser, managing director of BFW Invest, a European fund with EUR12 billion in assets under management, is considering a new construction opportunity on a one-acre (43,560 ft^2) property in Lisbon, Portugal. The project is expected to cost EUR5,000,000 and generate NOI of EUR540,000 in its first full year of operation following a two-year construction period. BFW has recently hired Sven Walters as a new analyst, and Steinhaeuser has asked him to evaluate this as his initial project. Steinhaeuser introduces Walters to the process of opportunistic private real estate investment by describing several aspects of this type of investment and follows up with a series of questions.

Steinhaeuser begins the discussion of how new construction projects are financed. She learns that Walters is already familiar with publicly traded REIT projects but has had little exposure to new construction financing.

Portugal has become very popular with immigrants from other EU countries settling in the country as remote workers and retirees, and the conversation turns to the current state of the Lisbon rental market. Given the influx of new residents, developers are seeking opportunities to add rental housing in Lisbon.

Steinhaeuser turns her attention to valuation issues. The plan is to incur 50% of project cost immediately and the remaining 50% in one year. She informs Walters that the cap rate assumed upon completion will be 9.2%. BFW currently uses a 10% hurdle rate for new construction projects.

Steinhaeuser addresses possible risks that would adversely affect project return. For example, labor issues could easily delay the completion of construction, while inflation and the rising cost of construction materials could easily cause returns

to fall below the project's base-case projections. Steinhaeuser mentions that, while unlikely, construction delays could potentially postpone the opening of the building by as much as one full year.

6. Describe two differences between the financing for a new construction project as compared with the acquisition of an existing income-producing property.

7. Identify the most likely current stage of the real estate cycle in Lisbon, and explain one possible risk associated with a new construction project in this market phase.

8. Based on the current assumptions regarding project cost, the construction schedule, future NOI, and the cap rate, calculate the IRR of the Lisbon project and evaluate the economic feasibility of this project.

9. Calculate the percentage by which NOI would need to increase if construction delays cause a one-year delay in the opening of the building (assuming all other assumptions remain the same with no cash flows in Year 2) for the building project to meet BFW Invest's hurdle rate.

The following information relates to questions 10-13

BFW Invest Considers a Value-Add Project

Because Sylvia Steinhaeuser at BFW Invest has been impressed with Sven Walter's work on the Lisbon project, she assigns him to another transaction in which the fund will buy an existing office building in Madrid slated for conversion to high-end residential apartments with retail space on the ground floor. The fund's hurdle rate on the project is 10%. Under its current use as office space, expected NOI during the next year is EUR1,400,000.

The purchase price is EUR15,000,000, and during the first year, Steinhaeuser estimates that NOI will be EUR1,000,000 as existing leases expire and office tenants relocate. Renovation will start in the second year, with net cash outflows of EUR4,000,000. New residential tenants are expected to occupy selected upper floors during the third year as renovation continues on lower floors, with net cash outflow of EUR1,000,000. By the end of Year 3, renovation is expected to be complete, with expected Year 4 NOI of EUR3,000,000 and expected property value after full renovation at the end of three years of EUR28,000,000.

After presenting the basic facts of the project, Steinhaeuser asks Walters about a contrast between this sort of renovation project and the new construction project that they recently discussed.

The analyst raises the issue of the possible effect of a recession on the renovation project returns. Steinhaeuser implies that such conditions may warrant an indefinite delay to the renovation. In such a case, the fund would plan to continue to operate the building in its current use as an office building.

Steinhaeuser realizes that she has not discussed the fund's fee structure with Walters. As a general partner, the fund charges annual management fees of 1.5% based on the size of initial investment and a performance fee of 20% based on returns in excess of the hurdle rate at the end of a three-year holding period. The performance fee is earned only if the investment performance exceeds a 10% hurdle rate, which occurs if Year 3 returns before fees are EUR23,153,000. The project will be financed only with equity and no additional transaction costs.

Steinhaeuser has noticed that the market for buildings in Madrid recently had been showing increased competition among buyers for the sort of property under consideration. As a result, she believes that a winning bid may need to exceed EUR15,000,000. She asks Walters to assess the maximum price that the fund could consider paying for the building.

10. Contrast the source of returns between a renovation project and a new construction project.

11. Evaluate whether the Madrid building purchase is economically feasible for the BFW Invest fund if it continues to operate as an office building.

12. Calculate the annual management fee and the performance fee for the Madrid property, and determine whether the after-fee performance of the investment meets BFW Invest's hurdle rate.

13. Determine the maximum price that BFW Invest could pay for the Madrid property while incorporating management fees.

SOLUTIONS

1. The correct response is B. Recession and recovery are both characterized by a lack of new construction that may likely result in an undersupply of residential housing. Response A is incorrect because the oversupply phase of the real estate cycle is less likely to coincide with a lack of housing. Response C is incorrect because these two phases of the real estate cycle do not coincide with one another; expansion usually moves into an oversupply phase prior to a recession.

2. Value-add real estate projects involve refurbishing or repurposing an existing income-producing property, while opportunistic real estate involves substantial development, such as new construction or redevelopment. Although both types of private real estate involve greater risk than stable income-producing properties included in core real estate, value-add properties typically generate income over some or all of the redevelopment phase, while opportunistic real estate usually generates no cash inflows until the project is complete and is likely to involve greater exposure to future lease rates upon completion. As a result, value-add real estate provides a less risky asset allocation during a recession.

3. Response B is correct. LTV refers to the loan to value ratio, with a higher LTV implying greater financial leverage and therefore higher risk. DSC refers to the debt service coverage ratio, with a lower ratio reflecting fewer resources available to service debt obligations and therefore greater risk. Given Northern States' expectation of a recession, the investment committee is most likely to amend its guidelines to reduce risk by lowering LTV and raising DSC requirements.

4. Response C is the best response. The lack of residential housing supply likely creates more competition between potential buyers, thus driving prices above what might be indicated by an income-based valuation model. Response B suggests that the NOI in direct capitalization models would be high, thus making the associated valuations high (not low). Response A also implies high valuations from a direct capitalization model.

5. As long-term investments that derive their value from the harvest of raw materials over the timber harvest cycle, timberland investment income is more closely related to the level of stumpage fees as opposed to lumber prices. Stumpage fees are much less volatile than lumber prices, because lumber is a finished product that also reflects costs associated with processing and transportation. For example, labor shortages throughout the supply chain can create lumber supply shocks while stumpage fees remain relatively constant.

   An additional revenue source from timberland investments comes from the purchase of carbon offsets in which carbon emitters pay timberland owners to delay harvests, which is similarly unaffected by lumber prices.

6. The first key difference relates to the timing of the financing. To purchase an income-producing building, the full proceeds of equity and debt financing must be available at the time of acquisition. A new construction project, in contrast, usually draws upon financing sources over time throughout the land acquisition and construction phases of the project based on the achievement of project milestones. Nevertheless, financing should be committed in advance.

   The second difference relates to the type of financing. The purchase of existing income-producing property usually involves a mortgage loan secured by the existing property. In the case of a new construction project, developers often initially draw upon an acquisition and development loan to finance the land acquisition

and a construction and development loan to finance project construction costs. As the building nears completion, developers often replace these loans with a mortgage loan secured by the property.

7. Given the local market dynamics described by Steinhaeuser, it is most likely that the Lisbon market is in an expansion phase of the real estate cycle. A possible risk related to this stage of the real estate cycle is that Lisbon may move to an oversupply stage by the time the project is completed.

8. The expected project cash flows are as follows:

Year	0	1	2
Cash flows	(2,500,000)	(2,500,000)	5,869,565

The first two cash flows reflect construction costs, while the Year 2 cash flow is the expected value of the completed building using the direct capitalization method. We may calculate this using Equation 3 based on Year 3 NOI of EUR540,000 and the cap rate of 9.2%:

$$\text{Property value} = \frac{\text{Expected NOI}}{\text{Capitalization rate}}.$$

$$\text{EUR}5,869,565 = \frac{\text{EUR}540,000}{9.2\%}.$$

Determine the economic feasibility of the project by comparing the IRR to BFW's 10% hurdle rate. Using the Excel IRR function [=IRR(-2500000,-250000000,5869565)], we may solve for the project IRR of 11.18%.

Because the IRR is greater than the hurdle rate, the Lisbon project appears to be economically feasible.

9. The construction delay shifts the final project cash flow from the end of Year 2 to the end of Year 3. We can solve for the Year 3 cash flow that generates a 10% hurdle rate using a trial-and-error process or the Excel Goal Seek function and confirm that the Excel IRR function [=IRR(-2500000,-2500000,0,6352717)] gives us a result of 10%. The original and revised cash flows are as follows:

Year	0	1	2	3
Original cash flows	(2,500,000)	(2,500,000)	5,869,565	—
Revised cash flows	(2,500,000)	(2,500,000)	—	6,352,717
IRR	10.00%			

Given a Year 3 cash flow of EUR6,352,717, we can show that Year 3 NOI (and expected building value) would need to be 8.23% higher than that in Year 2 for the project to achieve a 10% IRR:

$8.23\% = 6,352,717/5,869,565 - 1.$

10. Value-add and opportunistic private real estate investments are less focused on the income component of returns (the primary component of public real estate investment returns) and are more focused on the potential for capital appreciation during the development phase of the project. A significant contrast between a renovation project compared to a new construction project is that renovation projects may allow for cash inflows after the building is purchased while a new construction project is purely focused on the potential for capital appreciation. This contrast may be important in that after a building is purchased for renovation, the buyer may find that deteriorating economic conditions make it prefer-

able to continue operating a building as is until the real estate market reaches a recovery phase.

11. Based on the expected NOI of EUR1,400,000 for the Madrid building during the next year and a purchase price of EUR15,000,000, the project return can be calculated using Equation 2:

    Project return = NOI/Project cost,

    which is just 9.33% (= 1,400,000/15,000,000). Since this return falls below BFW Invest's hurdle rate of 10%, the Madrid building purchase is not economically feasible for BFW Invest if it is expected to operate indefinitely under its current use in the current rental market. In order for the property purchase to reach the hurdle rate, BFW would have to either lower its offer price or consider the possibility of a delayed renovation if the market improves in the analysis.

12. The annual management fee is EUR225,000 per year (= 1.5% × 15,000,000).

    To calculate the performance fee, we must first solve for cash flow at the end of the three-year holding period, which combines the EUR28,000,000 expected sale price and the net cash outflow of EUR1,000,000 in Year 3.

    Year 3 cash flow: EUR27,000,000 = 28,000,000 – 1,000,000.

    The performance fee is therefore

    EUR769,400 = 20% × (27,000,000 – 23,153,000).

    The before-tax cash flow, fees, and after-tax cash flow are as follows:

Year	0	1	2	3
Cash flows before fees	(15,000,000)	1,000,000	(4,000,000)	27,000,000
Fees		(225,000)	(225,000)	(994,400)
Cash flows after fees	(15,000,000)	775,000	(4,225,000)	26,005,600

    Use the Excel IRR function to calculate the IRR after fees:

    13.96% = IRR(-15000000,775000,-4225000,26005600).

    The resulting IRR after fees is 13.96%, which exceeds BFW's hurdle rate.

13. Because an earlier question also involved the calculation of the Madrid project IRR after fees, we can use the same information to determine the purchase price (or Year 0 cash outflow) using the Excel IRR function for which the IRR equals BFW Invest's 10% hurdle rate:

    10% = IRR(*Year 0 cash flow*,775000,-4225000,26005600).

    We can solve for the purchase price (or Year 0 cash flow) as EUR16,750,000 using trial and error or the Excel Goal Seek function. The cash flows are as follows:

Year	0	1	2	3
Cash flows before fees	(15,000,000)	1,000,000	(4,000,000)	27,000,000
Fees		(225,000)	(225,000)	(994,400)
Cash flows after fees with IRR = 13.96%	(15,000,000)	775,000	(4,225,000)	26,005,600
Cash flows after fees with IRR = 10%	(16,750,000)	775,000	(4,225,000)	26,005,600

LEARNING MODULE

7

Infrastructure

LEARNING OUTCOMES

Mastery	*The candidate should be able to:*
☐	discuss important infrastructure investment features
☐	discuss infrastructure investment methods and investment vehicles and their uses
☐	discuss the infrastructure investment process over the project life cycle and the roles of infrastructure debt and equity financing
☐	discuss the due diligence and valuation processes for infrastructure investments
☐	discuss the risk and return among infrastructure investments and as compared to other investments as part of a strategic asset allocation

INTRODUCTION 1

Infrastructure investments involve capital-intensive, long-lived assets whose underlying economic use is associated with the provision of essential services, such as transportation or power generation.

While sovereign, regional, and local governments borrow and levy taxes to build and operate infrastructure assets using public funds, our focus in this learning module is the features, structures, process, due diligence, valuation, and portfolio characteristics of private unlisted infrastructure investments. As of October 2022, private unlisted infrastructure remained the fourth largest private asset class after private equity, private debt, and real estate, with over USD1.25 trillion in global assets under management (AUM). This private asset class is forecast by the alternative investment data company Preqin to reach USD1.9 trillion by 2027, approaching the size of private real estate AUM.

Infrastructure investments are characterized by unique, often project-based structures with distinct cash flows and risk and return characteristics resulting from contractual or regulatory arrangements associated with public use. Like other private assets, infrastructure assets are typically large and illiquid—in some cases, involving existing government assets that are privatized, and in other cases, involving new assets built, operated, and often transferred to public use at the end of a predefined operating period.

In this reading, we first distinguish important features of private infrastructure. Infrastructure assets share similar life-cycle characteristics with private real estate but have important differences. As in the case of private real estate, these investments involve an initial development phase with negative cash flows, followed by a longer operating period over which costs are recovered and returns are generated. That said, the inability to repurpose single-use, long-lived infrastructure assets often means that their value is solely derived from contractual or regulatory relationships that govern their specific economic use in providing essential services. These relationships usually dictate the capital structure and investment process for debt and equity investors. While infrastructure assets are usually far less liquid and adaptable to other economic uses than non-infrastructure investments, they often benefit from inelastic demand, direct or indirect subsidies, or competitive and regulatory constraints that reduce business and operating risks. The use of special purpose entities to allocate project risks among public and private entities gives rise to unique due diligence challenges and distinctive risk and return features. Long-term stable cash flows from infrastructure investments combine bond- and equity-like characteristics that drive market-based valuation approaches and define their role in a strategic asset allocation.

LEARNING MODULE OVERVIEW

- Infrastructure investments are single-use, long-lived assets that may be classified on the basis of the inherent business risk faced by investors. The business risk depends on the specific security's place in the capital structure and its claim on cash flows of the underlying project, as well as the project type, corporate governance features, and geoeconomic exposure.
- Single-asset infrastructure companies typically involve a special purpose company with debt and equity investments closely tied to specific commercial contracts, while investments in entities engaged in multiple projects are more closely aligned with a corporate structure.
- Unlike private equity or real estate investments, which typically seek an exit in several years following capital appreciation due to restructuring or development, infrastructure investments that use a build–operate–transfer structure transfer their assets at the end of an operating period and therefore have a terminal value of zero.
- Due diligence challenges unique to infrastructure investments include jurisdictional, legal, and regulatory considerations; technical aspects of the engineering, procurement, and construction phase; and the commercial terms of their operation as defined by contractual or regulatory relationships.
- Given the unique and illiquid nature of infrastructure assets, valuation approaches generally focus on discounting expected cash flows over the commercial term using risk-adjusted discount rates.
- Because infrastructure assets are characterized by a relatively high payout of cash flows following a construction phase and their returns are less correlated with public bond and equity returns, their inclusion in a strategic asset allocation most often seeks to benefit from both diversification and long-term liability matching.

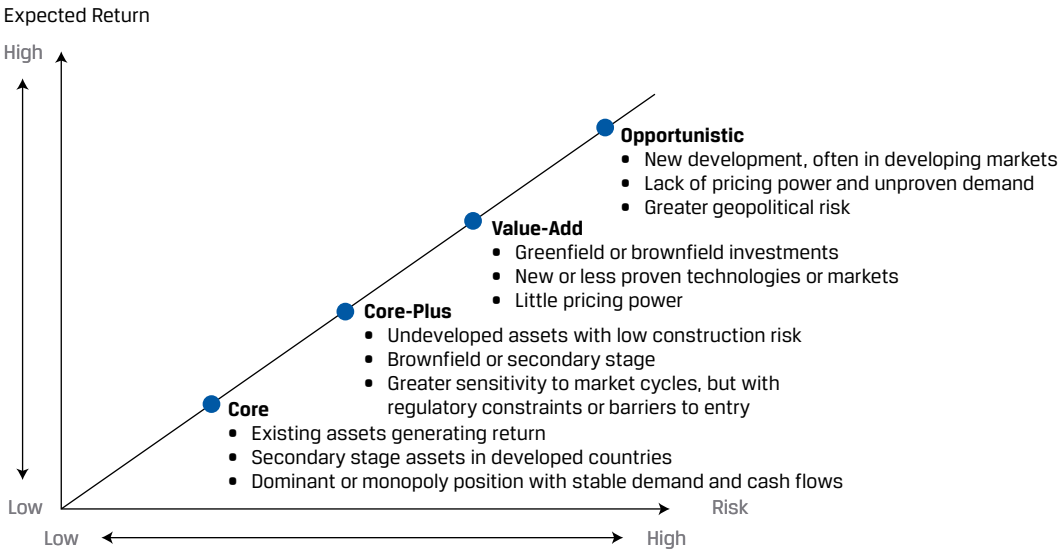
INFRASTRUCTURE INVESTMENT FEATURES

2

☐ discuss important infrastructure investment features

Infrastructure assets share some features of private commercial real estate investments but have critical differences. Both involve large, heterogeneous, illiquid investments in real assets that often follow a distinct development life cycle. However, whereas value-add and opportunistic commercial or residential real estate investments ultimately generate market rents as a primary source of revenue, infrastructure investments have little or no economic value beyond the public goods or essential services they provide. The unique contractual relationships among public and private entities related to the use of infrastructure assets creates distinct risk–return profiles for private investors. These investments are often grouped by the underlying industry associated with the service provided, such as power generation or transportation, as well as the associated stage of development. For example, new infrastructure projects and assets are referred to as **greenfield investment**, while **brownfield investment** may involve the privatization or repurposing of existing public assets or an expansion of existing facilities providing the same service. As with real estate investments, infrastructure projects and investment funds are often grouped by core, value-add, and opportunistic criteria, as shown in Exhibit 1.

Exhibit 1: Infrastructure Investment Risk and Return Spectrum



From an investment perspective, the source, type, and timing of compensation offered for the provision of these essential services or public goods is of primary importance. For example, in some cases, a local or regional government authority enters a **concession agreement** with a private firm that establishes terms and conditions to plan, build, operate, finance, and maintain an infrastructure asset, such as a toll road, bridge, or other facility. Under such an agreement, the public authority, often referred to as the **grantor**, provides the private developer or operator, also known

as the **concessionaire**, the right to charge user fees over a predetermined operating period to both recover construction and maintenance costs and provide a return to investors once the facility is completed and meets specifications.

Infrastructure investment returns are primarily derived from an asset's income-generating potential, because most projects are single-use investments with little or no alternative economic value. Furthermore, they are often built on public land or land acquired under government authority for fair market compensation and are frequently transferred to the public entity at the end of an operating period with a terminal value of zero.

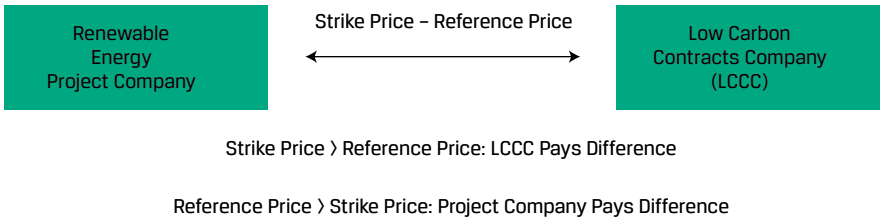
A key feature that distinguishes infrastructure from other investments is the underlying business model. In contrast to corporate issuers or real estate, long-term contractual arrangements clearly define services provided, as well as the economic terms. Infrastructure investors may act as private project developers and/or asset operators.

Private developers may agree to build a hospital, a bridge, or power generation facilities to certain technical specifications required to deliver services and receive progress payments during construction and upon completion. Asset operators generate revenue that usually involves one of three possible approaches:

> *Fixed or availability-based payment:* Public or private sector end users agree to payment of a fixed income stream over the period during which the asset is available for use. An operator must meet all construction, operating, and financing cash flows from this income stream. Under this arrangement common among **social infrastructure** investments, or those directed toward education, health care, and other government services, as well as the transport and energy sectors, the asset is often returned to the public sector entity and the terminal value is zero.
>
> *Commercial payment:* Under a commercial or so-called **merchant payment scheme**, the operator has the right to collect service or user fees over the operating period but remains exposed to the asset's business risk based on demand and other economic factors. Merchant payment schemes are frequently used for power generation and toll road assets.
>
> *Regulation-based payment:* In network-based industries where natural monopolies are common, such as power or water distribution, public authorities often seek to stabilize pricing or impose pricing restrictions. These measures may be designed to offer a specific return on investment, limit price adjustments to the rate of inflation or a predetermined rise in service charges, or encourage investment in a particular area or technology. While this approach has the effect of limiting potential returns, it also may be used to encourage investment by reducing business risk to investors.

Regulation-based payments are also used to promote investment in renewable energy. For example, the United Kingdom is one of several developed market countries that uses **contracts for difference (CfDs)** as a primary mechanism to promote investment in low-carbon electricity generation, such as wind and solar power. CfDs are used by the **Low Carbon Contracts Company (LCCC)** to stabilize a project's renewable energy income, as shown Exhibit 2.

Exhibit 2: Contracts for Difference in UK Renewable Energy



Qualified low-carbon energy project developers bid on a fixed, likely inflation-adjusted, indexed electricity rate for periodic future delivery over 15 years, with successful bidders entering a CfD with the UK government–owned LCCC. Under the CfD, a developer exchanges the difference between the **strike price**, or the fixed contractual rate agreed at a CfD auction for each period, and a **reference price**, or the average UK electricity market price for the period. For intermittent projects, such as wind power, market reference prices for a given day are set hourly based on the prior day's power auctions.

If the pre-agreed strike price exceeds the market reference price, the project company receives the difference from LCCC, while the project company must pay LCCC the difference when the market price exceeds the strike price, thus ensuring a stabilized electricity price for the contracted period and volume.

KNOWLEDGE CHECK: WYNDSIDE LIMITED CONTRACT FOR DIFFERENCE

Wyndside Limited is an onshore wind farm that was awarded a 15-year CfD at auction with a strike price of GBP230.18 per MWh for 25 MW (1MW = 1,000 kW) of power. The **intermittent market reference price (IMRP)** is the market reference price determined daily on the basis of the prior day's hourly electricity rates.

1. Explain how the CfD is used to determine Wyndside's income for the quarter (equal to 90 days) if the IMRP for the current quarter is GBP208 per MWh. Assume no CfD inflation adjustment, 24-hour daily operation, and constant 25 MW per hour output.

   Solution:

   If the pre-agreed strike price under the CfD exceeds the market reference price, then Wyndside receives the difference from LCCC. Wyndside's income is the sum of the electricity income based on IMRP plus the CfD settlement:

   Wyndside income (IMRP): 11,232,000 = GBP208 × 25 MW × 90 days × 24 hours.

   CfD settlement: 1,197,720 = (230.18 – 208) × 25 MW × 90 days × 24 hours.

   Wyndside income: GBP12,429,720 = 11,232,000 + 1,197,720.

   While this CfD settlement mechanism addresses a contractual volume for a given period, note that wind farms in practice are subject to output vari-

ability due to seasonal and weather conditions, among other factors, which prevent them from fully offsetting revenue-related risk.

Single, standalone projects are usually governed by a **special purpose entity (SPE)**, also referred to as a special purpose vehicle (SPV), established to undertake a project. This approach is similar to asset-backed securities, where a standalone SPV is created to purchase loans from an originator and issue securities backed by loan interest and principal payments. In the case of a project SPV, the entity's sole purpose is to facilitate the construction, operation, and financing of an infrastructure asset over its contractual life both by limiting the liability of private firms that build, operate, and maintain the asset in exchange for contractual or commercial operating cash flows and by limiting debt and equity investor claims to a project's net cash flows.

The long-lived, illiquid nature of infrastructure investments combined with the contractual and business risk characteristics we have outlined result in unique infrastructure cash flow, diversification, and exposure profile features:

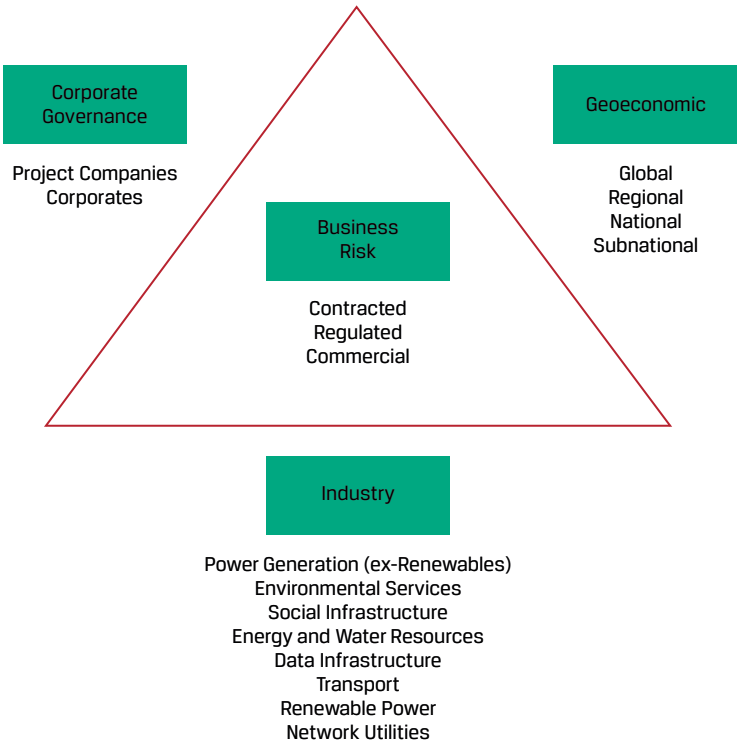
Cash flow features: As long-lived, single-use assets, infrastructure investments typically offer investors a higher cash yield than other asset classes because there are limited opportunities for cash flow reinvestment into an existing project. As a result, equity investors can usually expect a higher proportion of revenues as dividends, while debtholders are often able to receive relatively high yields compared to similar investments with low credit risk.

Diversification features: Given the provision of essential or public services that often have few substitutes and inelastic demand, infrastructure asset returns typically exhibit lower correlation with other asset classes and tend to be less exposed to cyclicality or market downturns. For example, according to a study by PGIM, a global investment management firm, the total return correlation between private infrastructure equity assets and public equities from 2012 to 2021 was 0.57, which is higher than that of equities and fixed income but lower than correlations between types of private equity.

Exposure profile features: Given the distribution of relatively predictable cash flows over extended contractual periods, infrastructure assets offer the potential for cash flow or liability matching for long-term institutional investors, such as pension funds, as a source of income and portfolio duration.

Given the unique nature of infrastructure project risks, the EDHEC Infrastructure Institute initiated the **Infrastructure Company Classification Standard (TICCS)** in 2018, with the input of asset owners and asset managers, to categorize investments based on key characteristics affecting relative risk and return. These features include the form of business risk, the underlying industry, corporate governance, and geoeconomic exposures, as shown in Exhibit 3.

Exhibit 3: The Infrastructure Company Classification Standard



Business risk characteristics of infrastructure investments at the center of the exhibit were defined earlier by whether cash flows are fixed or availability based, merchant, or commercial, or regulation based. These cash flows constitute the income over the asset's period of operation used to cover upfront development and construction costs and ongoing maintenance upon completion and to compensate investors over an asset's life. Given their long useful life, regulatory risk in the form of political, legal, and governmental change is an additional feature of business risk for infrastructure assets. The anticipated level and volatility of cash flows affect not only the level of risk and return but also the degree to which leverage can be used to finance these long-lived assets.

The *industry* classifications shown at the bottom of Exhibit 3 used to group and evaluate private companies are important, but they often ignore key distinctions associated with the development and operation of infrastructure assets. Industry risk factors include cyclicality, concentration, and competitive intensity, as well as growth and demand. While an investment's technical and physical features may be similar to other investments in the same industry, relative risk and return are often dictated by the business model. For example, a power generation facility that delivers electricity to the power grid under a government-sponsored price stabilization scheme may face less business risk than an identical facility with a long-term power purchase agreement with a private manufacturing company, but it bears more regulatory risk. Also, while low-carbon energy solutions may benefit from income stabilization schemes as described earlier, traditional power-generation assets face the risk of tighter environmental restrictions over their useful life. Infrastructure assets in the same sector therefore often require groupings with greater specificity based on the types of services rendered, technologies employed, and customers, as well as the terms of service.

The type of *corporate governance* shown on the left side of Exhibit 3 refers to the use of single-asset project companies typically governed under SPEs, as opposed to multi-project corporations engaged in infrastructure. The choice of corporate governance used directly influences project capital structure; the contractual framework governing the development and operation of a single asset imposes tighter constraints on managers than under a corporate structure with multiple projects. Lenders can exercise greater control over the sources and uses of cash flow for a single project and are therefore usually more willing to offer higher leverage in comparison to debt financing considered for a multi-project corporate structure. In the case of publicly traded infrastructure companies involved in multiple projects, debt and equity investors in liquid securities are exposed to an evolving project portfolio over time as opposed to a single-use asset for a finite period. For example, in the case of Hochtief AG, a publicly traded construction and global infrastructure company based in Germany, the company has shifted its focus from German reunification projects in past years to such new areas as energy transition, digital infrastructure, and sustainable mobility.

Finally, *geoeconomic* classification on the right side of Exhibit 3 refers to the local, national, or global exposures associated with an infrastructure asset. For example, as with real estate assets where income depends on local economic conditions, investors often seek geographic diversification among similar infrastructure assets whose commercial revenue stream is closely tied to economic activity, such as traffic for toll roads and business and leisure travel for airports. In some cases, a project may directly hinge on the creditworthiness or counterparty risk of a local or national government, while in others—such as bridges, ports, or distribution networks—a project's viability may depend on the level of cross-border activity or global trade. These large, immobile assets depend directly and indirectly on national government policies to determine how public entities partner with private sector entities to develop and operate infrastructure. These so-called **public–private partnerships (PPPs)** take many forms but are usually defined as a long-term contractual relationship between the public and private sectors involving a concession agreement or other form of compensation in exchange for delivering an essential service or public good.

While private market solutions to address the provision of public goods are often seen as an attractive investable alternative to schemes funded entirely through fiscal budgets, PPPs often face unique and unforeseen risks when put into practice. For example, while the vast majority of transport infrastructure investment following German reunification was funded through taxation, the following private project example illustrates some of the challenges faced when estimating usage and revenue for any infrastructure project, whether publicly or privately financed.

WARNOW TUNNEL PROJECT

The Warnow tunnel, a 0.8 km road tunnel under the Warnow River in Rostock, was the first German toll road constructed following the passage of the Private Highway Construction Financing Act after reunification. Under the new law, a new form of PPP known as the F-Model was used; it transferred the right to collect tolls to private investors but involved a bidding process that took place prior to formal project approval.

Completed in 2003 at a cost of EUR220 million, the Warnow tunnel was nearly bankrupt within three years of completion. The investors and planners had overly optimistic traffic forecasts, particularly for trucks facing much higher tolls than passenger cars. Truck drivers chose instead to take a 10–15 km detour on public roads rather than incurring the EUR9.00 (or EUR17.50 in summer) toll per vehicle, and overall tunnel traffic remained at roughly half the level necessary for the project to be profitable. Following a two-year period of

negotiation with the City of Rostock as grantor, the operating concession was extended from 20 years to 50 years and the toll structure was adjusted to make the project economically feasible for the operator.

This widely cited example is often used to describe the pitfalls of the so-called F-Model and to justify subsequent changes to German PPP transport structures.

The role of private infrastructure investments differs markedly in developed and developing countries for several reasons.

Developed markets are characterized by diversified domestic economies with a strong financial sector, extensive existing domestic transportation and energy networks, and fiscal budgets that provide essential services and public goods through taxation and borrowing. Private infrastructure is prevalent in industries in which public sector assets are privatized or a well-established regulatory framework governs activity, such as power and water utilities or transportation. In other cases, government intervention is used to promote either brownfield investment to revitalize disadvantaged areas or greenfield development to stimulate growth in such areas as renewable energy.

Developing countries, in contrast, face less economic diversification, few budgetary resources to provide public goods, evolving transportation and energy networks, and a less robust financial sector with a greater likelihood of domestic currency devaluation, which creates currency risk. In these cases, private infrastructure investment is more often greenfield than brownfield and tied to projects that seek to provide a catalyst for overall economic growth and development. Global and regional development banks and supranational financial institutions, such as the World Bank and its affiliate, the International Finance Corporation (IFC), frequently play a pivotal role in providing technical assistance to these countries for infrastructure investments, such as concession agreement terms, standard bidding documents, and legal and regulatory advice, as well as various forms of financing. Private investors in developing market infrastructure typically look to the engagement of these public and other private entities with experience and expertise with similar projects to mitigate country and political risk associated with long-term illiquid developing market investments.

In contrast to developed markets, infrastructure asset performance in developing economies often hinges on the market for a key global commodity or domestic industry that may be a driver of continued economic development, as well as a critical source of foreign currency reserves. While developing market investments are less frequently associated with brownfield investments, the following fictional case study provides a counterexample in which existing infrastructure may be repurposed to align resources to national government priorities using private investment.

CASE STUDY

Tay Bac Airport (Vietnam)

In response to growing cross-border travel and trade in the northwestern Vietnamese province of Tay Bac, the Vietnamese Ministry of Transport has proposed the repurposing of an abandoned military airport site for civilian use as a regional airport to primarily serve passengers on domestic routes and connecting flights to global destinations, promoting tourism, trade, and local economic growth.

The Ministry of Transport intends to work in conjunction with the IFC under a plan where private sector firms will design, build, finance, operate, and maintain the Tay Bac Airport (TBA) facilities over the next 20 years.

The proposed commercial arrangement between the Ministry of Transport and the airport operator foresees nominal concession payments related to airport operations, with the bulk of expected project revenue based on commercial payments tied to airport traffic, as well as the right to generate ancillary revenues from parking, duty-free shopping, and other sources on the property.

1. Describe TBA's infrastructure investment features using TICCS.

   Solution:

   Corporate governance: As a single standalone project, we would expect the Tay Bac Airport project to be built and operated using an SPE structure to accommodate long-term contractual relationships between public sector project sponsors and private sector parties involved in the design, construction, financing, operation, and maintenance of airport facilities.

   Business risk: Tay Bac Airport's business risk and business model primarily involve a commercial payment scheme, because projected airport revenue is reliant on passenger and cargo traffic and other traffic-related revenue.

   Geoeconomic risk: Because TBA is in the transport sector and associated with goals of promoting tourism, international trade, and economic growth via both domestic travel and connections to global routes, TBA's geoeconomic risk involves both global and national exposures.

   Industry Risk: The project will have significant exposure to the tourism industry, as well as some exposure to ancillary industries related to the operation and upkeep of the facility.

Despite their obvious differences, the Wyndside and Tay Bac Airport projects share several common features, such as their lack of adaptability to alternative economic uses and a development period with negative cash flows followed by a period of contractual cash inflows available to pay development costs and generate investor returns. The investment methods and structures used to achieve the objectives of the public and private parties involved, as well as third-party investors, have similar features. Infrastructure investments span the development and operation cycles as shown in the following section.

QUESTION SET

1. Describe two possible rationales for establishing a special purpose entity for governing a private infrastructure project.

   Solution:

   In the case of a project SPE, the entity's sole purpose is to facilitate the construction, operation, and financing of an infrastructure asset over its contractual life. For private infrastructure projects, an SPE has the effect of both (1) limiting the liability of private firms that build, operate, and maintain the asset in exchange for contractual or commercial operating cash flows and (2) limiting off-balance-sheet debt and equity investor claims to a project's net cash flows.

2. Which of the following corporate governance structures in private infrastructure is likely to allow for greater debt financing assuming similar creditworthiness?

   A. Single-asset companies

   B. Multi-project companies

   C. Publicly traded infrastructure companies

   Solution:

   The correct response is A.The choice of corporate governance used directly influences project capital structure; the contractual framework governing the development and operation of a single asset imposes tighter constraints on managers than under a corporate structure with multiple projects. Lenders can exercise greater control over the sources and uses of cash flow for a single project and are therefore usually more willing to accept a higher degree of leverage than under a corporate structure (i.e., multi-project companies or publicly traded infrastructure companies).

3. Vento Anglio Limited (VAL) is a private 125 MW onshore wind farm project planned in western England. Because it expects to qualify as a low-carbon energy project developer, VAL intends to take advantage of the UK government's CfD scheme and deliver electricity to the local power grid. Describe VAL's infrastructure investment features using TICCS.

   Solution:

   Corporate governance: As a single, standalone project company, we would expect VAL to be governed by a special purpose entity) established solely to undertake the wind farm project as opposed to a corporate structure.

   Business risk: Given its intention to use a contract for difference (CfD) scheme to stabilize power revenue, we should classify VAL's business risk as involving regulation-based payments, since the CfD contract stabilizes electricity prices for the life of the contract for difference.

   Industry risk: VAL's underlying industry is the renewable power sector.

   Geoeconomic risk: Changes to the domestic UK government's programs to encourage investment in renewable energy are a form of geoeconomic risk.

INFRASTRUCTURE INVESTMENT STRUCTURES

3

☐ discuss infrastructure investment methods and investment vehicles and their uses

Infrastructure investments take several forms similar to those from other private markets, ranging from fund investments in a portfolio of infrastructure assets or projects, co-investment, or direct investment in a project or asset.

While smaller investors that are unable to accommodate sizable stakes in these often large-scale, highly illiquid, single-use assets typically invest as one of many limited partners, larger institutional investors frequently consider significant minority, majority, or 100% ownership, as in the following example.

PUBLIC SECTOR PENSION (PSP) INVESTMENTS IN INFRASTRUCTURE

PSP Investments was established in 1999 by the Canadian government to manage and invest the public sector pension plans of the federal Public Service, the Canadian Forces, the Royal Canadian Mounted Police, and the Reserve Forces. PSP's assets under management grew during its first 20 years of operation to over CAD200 billion.

Beyond public market equities and fixed income, PSP expanded to private market investments, including infrastructure, seeking to invest in large assets with stable long-term cash flows to match its liabilities for very long tenors with no exit requirements. PSP participates in both co-investment opportunities with significant minority ownership stakes and 100% direct investments, such as AviAlliance.

AviAlliance is a leading global airport investor and manager based in Germany, which PSP acquired from Hochtief AG, a publicly traded global infrastructure company, over a decade ago.

In contrast to other private market investments, infrastructure assets often require a high degree of technical, engineering, regulatory, and other expertise to ensure the physical and economic feasibility of a project over its life cycle. Smaller general partner (GP) funds and other investors who are unable to make large investments and lack the necessary depth of resources and sector- and asset-specific expertise often seek to co-invest in projects led by a major fund manager, sovereign wealth fund, or pension fund with greater experience. As infrastructure involves essential services or public goods created and supported in tightly regulated markets governed by regional or national authorities, public entities often play a key role in determining the investment method, types of financing, and parties involved. In other instances, especially in developing countries, regional development banks or supranational entities, such as IFC, offer technical assistance for engineering and financing proposals and bid processes.

Most developed market governments have created **export credit agencies (ECAs)** to promote the export of domestic goods and services via credit insurance, subsidized or guaranteed debt financing, which is often a key factor in reducing cost, extending the tenor, or increasing the availability of debt financing for capital goods used in developing market infrastructure.

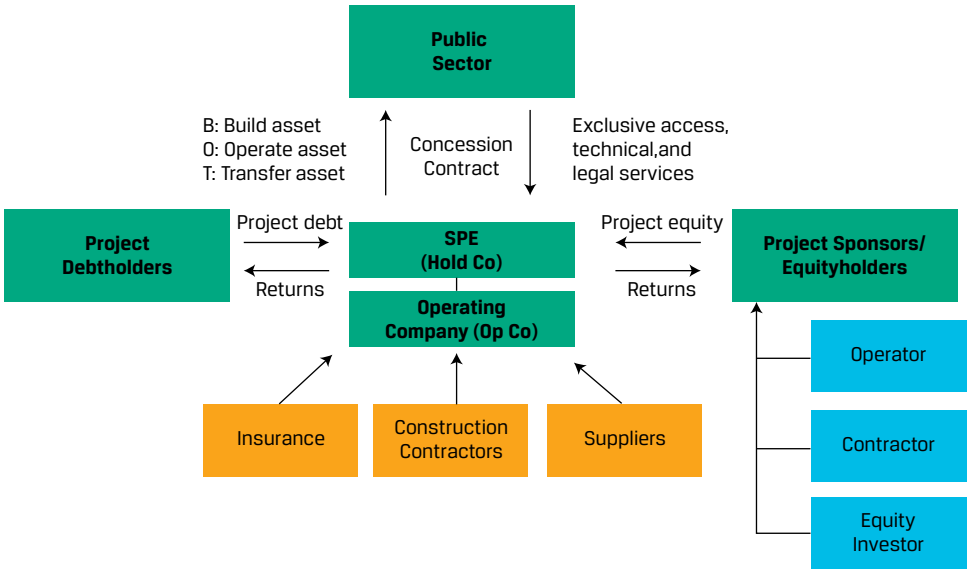
In the case of a UK wind farm, the project requires assembly, installation, and operation of the wind turbines to generate and transmit electricity to the power grid at optimal levels and in compliance with the British Standards Institution and pricing regulated by the Office of Gas and Electricity Markets. The UK Department of International Trade has sponsored initiatives seeking to attract foreign investors to provide debt and equity financing for renewable energy.

As for Tay Bac Airport in Vietnam, introduced earlier, the facility must meet physical feasibility requirements of aircraft, passengers, and cargo. International passengers, airlines, and freight companies will also expect Tay Bac Airport to meet high global service requirements, such as the International Air Transport Association's standards of interoperability and technology. Transport linkages requiring local and regional authority agreements to provide road, rail, and other onward travel connections are important elements required to attract and accommodate traffic over the concession period.

These complex contractual relationships among developers, contractors, suppliers, private and public service providers, managers, and investors are usually governed through an SPE structure over a project's life cycle. Because no two projects are identical, the form of an infrastructure project SPE is often uniquely structured to follow

its function in establishing and allocating sources and uses of cash, as well as risks, roles, and responsibilities among parties involved. Exhibit 4 provides a generalized structure of a special purpose entity.

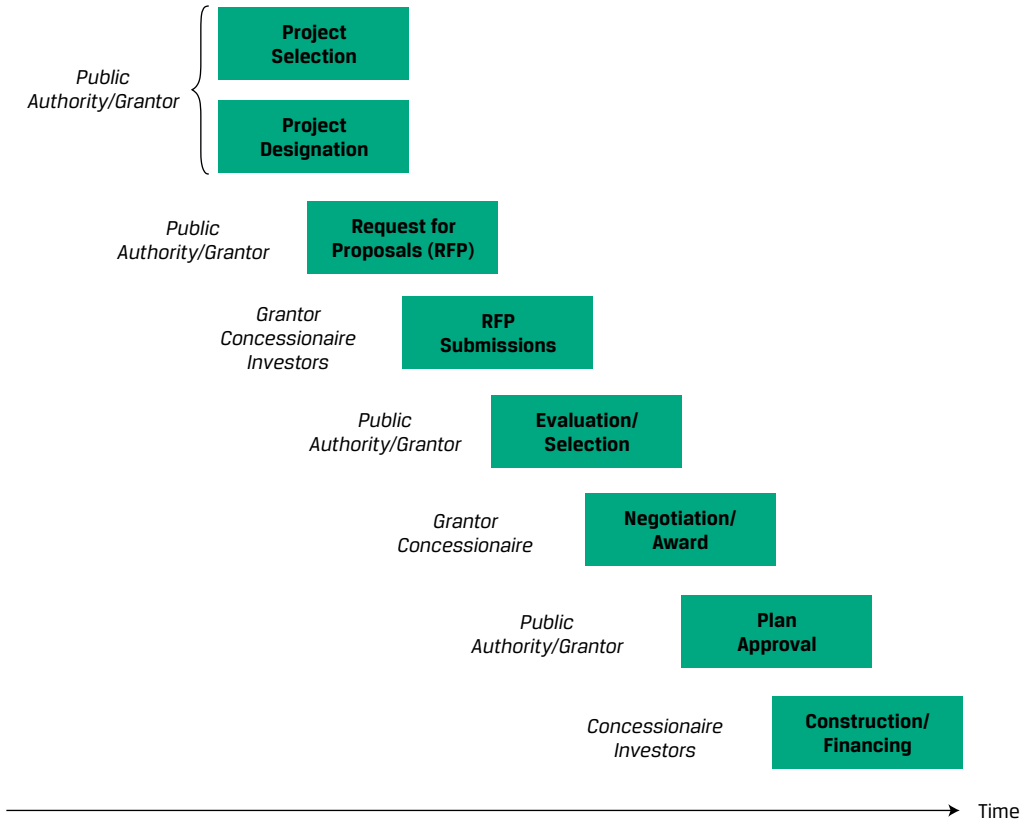
Exhibit 4: Infrastructure Project Special Purpose Entity



As Exhibit 4 shows, the project SPE is often a separate holding company (shown in the diagram as HoldCo) established for financing purposes that also has an operating company (or OpCo) that holds the assets, contracts with related parties, and generates cash flows. In some cases, both entities issue securities and investors must be aware of the seniority of their claim depending on the issuing entity and the project cash flows.

In addition to their legal segregation using SPEs, infrastructure investments are often governed by a set of standardized procedures for the selection of parties involved in the development, construction, operation, and financing of the project once its size, scope, and timing are determined. Key steps in the process are shown in Exhibit 5.

Exhibit 5: Infrastructure Project Bidding Process



The **request for proposal (RFP)** outlines project details, requirements, and timing, as well as assessment criteria used to award contracts to successful bidders. In addition to laying out the size, scope, technical specifications, and the nature of essential services to be provided by an infrastructure asset to all interested parties submitting a sealed bid for the project, the RFP process also aims to promote a fair, competitive, and transparent process for all parties involved.

To better understand how these infrastructure methods and structures work in practice, we now return to the case of the Vietnamese airport introduced earlier. In the case of Tay Bac Airport, private investors engage with global institutions, public sector authorities, and private entities with extensive experience and expertise in developing and operating regional airports to mitigate associated geoeconomic risk, as shown in the following case study.

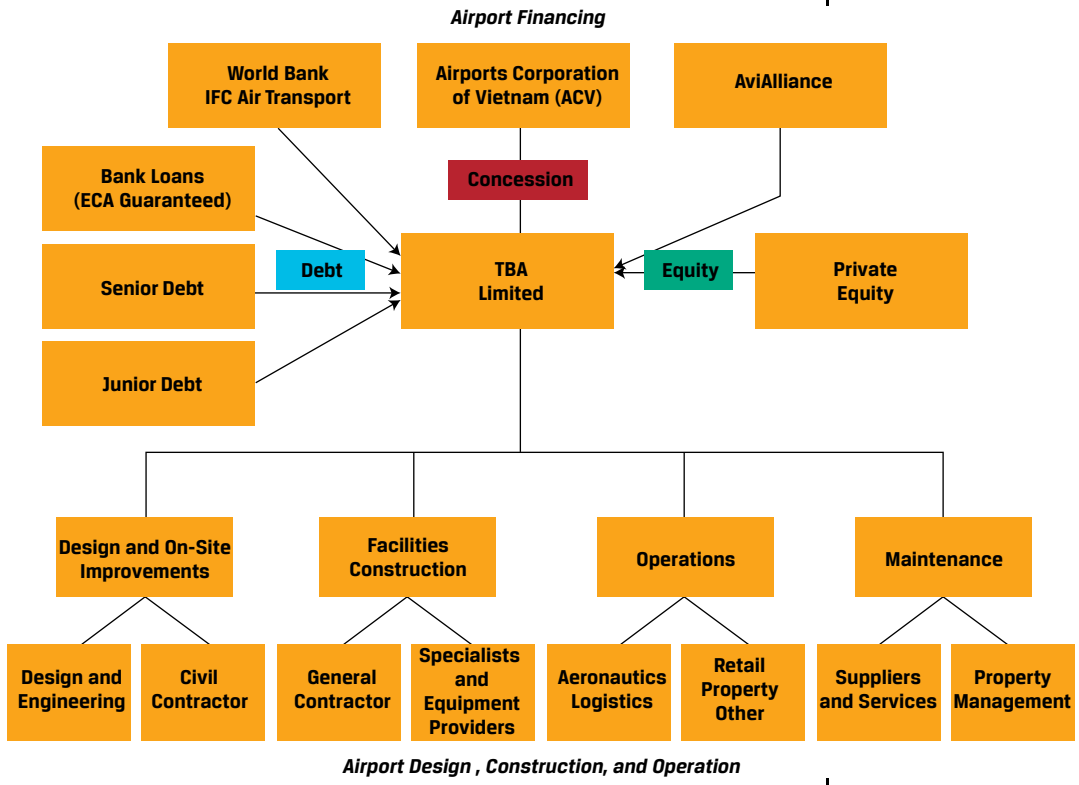
CASE STUDY

Tay Bac Airport Limited Investment Vehicle and Structure

The state-owned Airports Corporation of Vietnam (ACV), a subsidiary of Vietnam's Ministry of Transport and operator of Vietnam's existing international airports, has completed a successful RFP process for the design, construction, financing, and operation of the new Tay Bac Airport on 500 hectares of government land on an abandoned military site in northwestern Vietnam, and it was awarded the contract.

The project is co-sponsored by the IFC as a provider of both technical support and debt financing and AviAlliance, a private industrial airport investor, manager, and equity provider. Tay Bac Airport Limited (TBA Limited) was established as the project company and concessionaire, with ACV serving as grantor over the 20-year period, with ownership and control transferred to ACV at the end. TBA Limited's structure is summarized in Exhibit 6.

Exhibit 6: TBA Limited Structure



As shown in the diagram, TBA Limited has four sources of debt and two sources of equity financing and intends to directly contract with design and civil contractors in the initial development phase and general and specialist contractors over the facility construction period and for operations and maintenance once TBA is operational.

TBA is projected to cost USD900 million, as shown in the following table, with 65% of the project (or USD585 million) funded with debt and the rest with equity:

TBA Development Costs	USD
Facilities	515,000,000
Equipment & Systems	135,000,000
On-Site Land Improvements	100,000,000
Civil Engineering	90,000,000
Parking & Transportation	50,000,000
Upfront Costs & Reserves	10,000,000
Total	900,000,000

1. Explain the benefits to a TBA Limited debt or equity investor of investing directly with the special purpose company as opposed to the Airports Corporation of Vietnam over the concession period.

   Solution:

   The legal separation between TBA Limited (the SPE concessionaire) and the Airports Corporation of Vietnam (the grantor) provides important benefits to both debt and equity investors of the infrastructure project.

   First, investors are protected from cash flow risks arising from other assets (i.e., all other airports in Vietnam) associated with the grantor. The cash flows to investors are strictly associated with the Tay Bac Airport asset.

   Second, investors can focus any monitoring efforts solely on the operations of Tay Bac Airport as opposed to monitoring Airports Corporation of Vietnam.

2. Discuss the potential benefits of using ECA-guaranteed bank loans as debt for the TBA project.

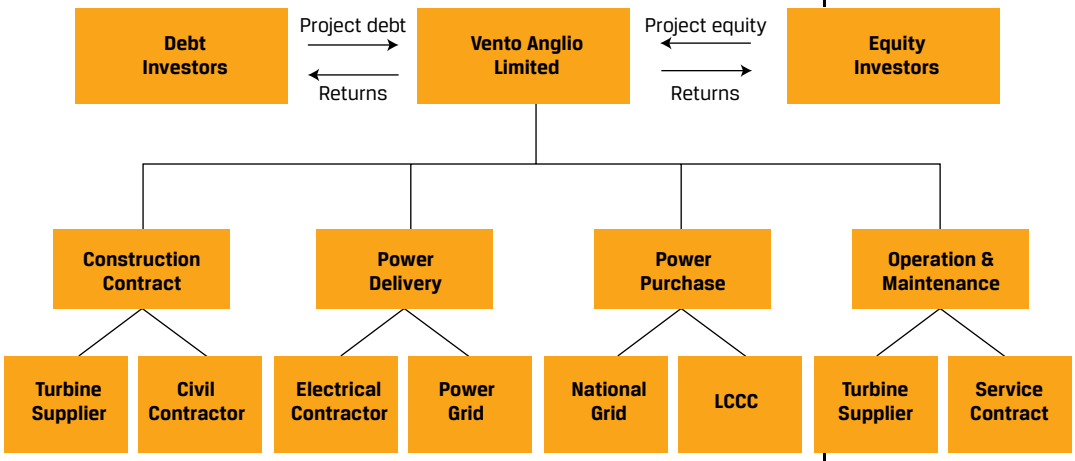
   Solution:

   Developed market governments create export credit agencies to promote the export of goods and services via credit insurance and political risk insurance protecting against project expropriation and the inability to repatriate cross-border cash flows and subsidized or guaranteed debt financing. These features of ECAs assist in reducing cost, extending potential tenor, and increasing the availability of debt financing for capital goods used in developing market infrastructure. Thus, the use of the ECA-guaranteed bank loans likely comes at lower interest rates and with better loan terms than non-guaranteed debt. The guaranteed feature also should provide additional confidence to other possible lenders on the project.

QUESTION SET

A private equity GP initiates the 125 MW Vento Anglio project by entering into a GBP1.825 million land use contract for 12,000 acres of remote land to build and operate a wind farm following community engagement and receipt of local authority permits. The GP establishes Vento Anglio Limited (VAL) with the basic structure in Exhibit 7.

Exhibit 7: VAL Structure



The VAL wind farm is projected to cost GBP160 million, as shown in the following table, using GBP50 million in equity and the remainder in debt financing:

VAL Development Costs	GBP
Land Use Cost	1,825,000
Wind Turbines & Related Costs	137,500,000
Site Setup Costs	1,600,000
Development Fees	2,300,000
Contingency	6,500,000
Interest Reserves	4,020,000
Operating Deficit Reserves	4,255,000
Miscellaneous Closing Costs	2,000,000
Total	160,000,000

The VAL wind farm has a 30-year expected life, after which the turbines are expected to be recycled to cover wind-down costs and the land will be returned to owner use.

1. Explain the benefits to wind turbine suppliers and LCCC of contracting directly with the special purpose entity VAL versus the private equity GP.

   Solution:

   Because of the specific and technical nature of an infrastructure asset like the Vento Anglio project, an SPE can be organized and staffed to provide the unique project knowledge required to interact with suppliers to the project (such as the wind turbine suppliers and LCCC). The private equity general partner, in contrast, is unlikely to be staffed with such asset-specific expertise.

2. Identify key differences between the structure of VAL compared to the structure from the TBA example presented earlier in the lesson.

   Solution:

   The VAL structure does not include a grantor as in the TBA scenario in which Airports Corporation of Vietnam (ACV) grants the concession to build, operate, and transfer Tay Bac Airport to ACV at the end of the contract. There is also no ECA supporting debt issuance.

While VAL will interact with government authorities through the process of providing electricity to the national power grid and obtaining local permits, it is not a concessionaire as in the TBA example. Finally, unlike TBA, which is transferred to ACV for continued operation, the VAL project does not remain in operation at the end of the project's life.

3. Evaluate a critical area of technical expertise necessary for VAL management based on the development costs shown previously and discuss the implications of a lack of expertise.

   Solution:

   Of the GBP160 million cost budget for the project, almost 86% of these costs are classified as wind turbine and related costs. As a result, it is imperative that the private equity GP ensure that the VAL management team has a high degree of expertise in the construction and operation of wind turbines. A lack of knowledge in this critical aspect of building a wind farm may cause delays, cost overruns, and other adverse events that may substantially reduce project returns.

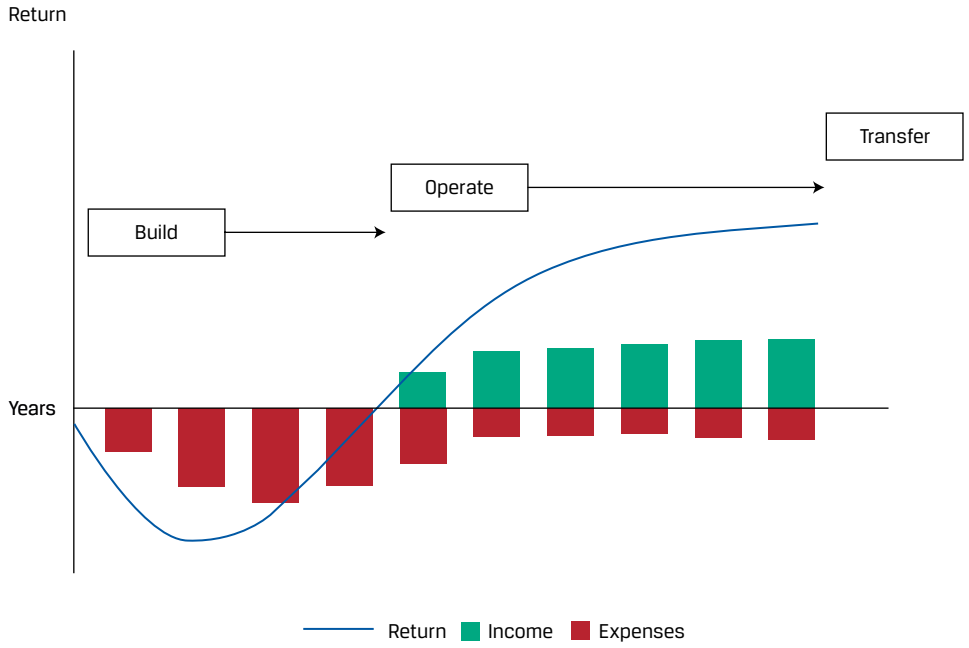
4 INFRASTRUCTURE INVESTMENT PROCESS

☐ discuss the infrastructure investment process over the project life cycle and the roles of infrastructure debt and equity financing

Private market investments such as venture capital, growth or buyout equity, or value-add or opportunistic real estate projects are often characterized by value creation over a transformational life cycle. Several features of infrastructure assets affect their value creation process in the project life cycle, including their size, a higher degree of illiquidity, and lack of ability to repurpose, in contrast to other private market investments. As we have discussed, these large-scale fixed assets involve a development process with sizable sunk costs to deliver specific essential services or public goods under contractual relationships established with public entities. Unlike private equity investors who may alter restructuring or company exit plans based on market conditions or private real estate investors who may repurpose a property to meet changes in demand, infrastructure investments are usually more difficult to liquidate or convert to alternative uses.

Infrastructure asset inflexibility extends beyond the development phase to the period of operation and in many cases to the final asset transfer to public ownership, resulting in a zero terminal value to investors. The phases of such a **build–operate–transfer (BOT) project** are shown in Exhibit 8.

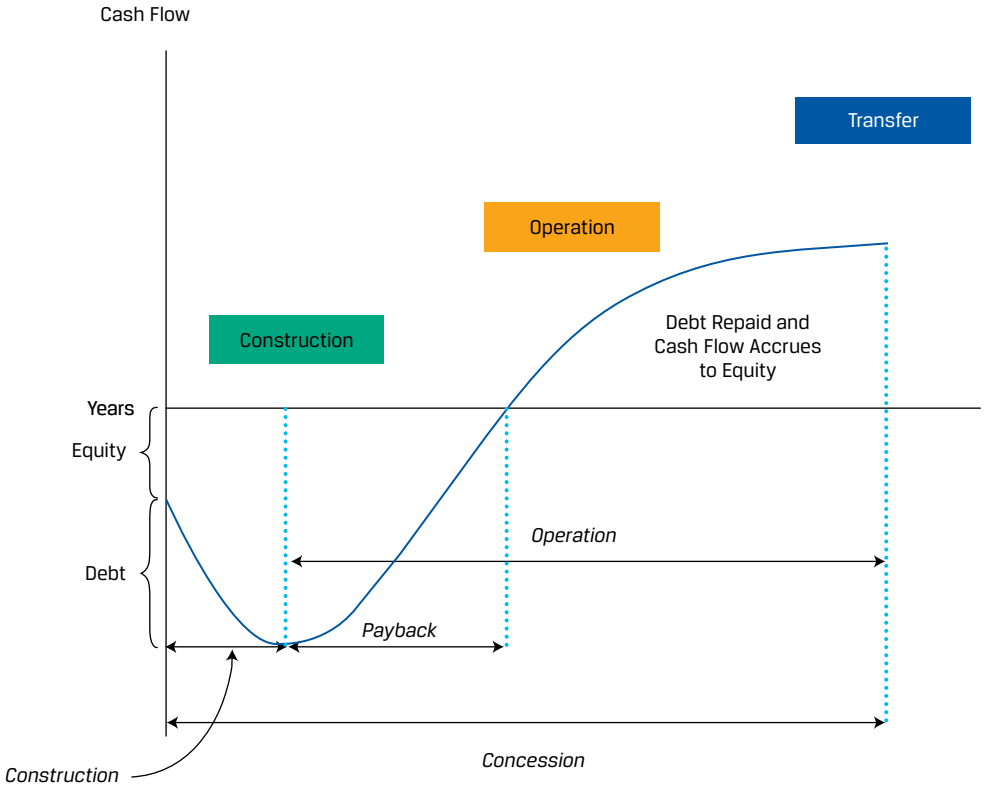
Exhibit 8: Infrastructure Project Build–Operate–Transfer Life Cycle



BOT projects are characterized by an initial construction or "build" phase, followed by a predefined operating period over which contractual or commercial cash flows are generated before the asset is transferred to a public authority. Given the high degree of sunk costs in these specialized fixed assets, the payout period of infrastructure assets typically spans several decades. In developed markets, BOT projects are most common in such sectors as transportation, energy and water resources, and other network utilities for which large-scale investment is required for projects with a high level of fixed assets and long operating periods. In developing countries, BOT structures are commonly used to attract foreign investors in partnership with multilateral funding agencies for selected projects necessary to support economic growth where public funds are inadequate.

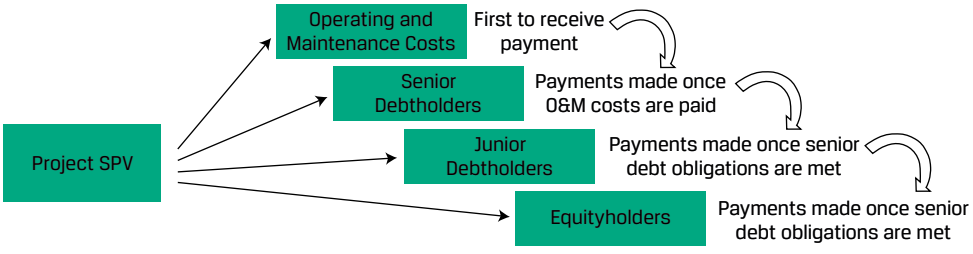
The use of debt versus equity financing also differs over the infrastructure asset life cycle versus other private investments. Many private investments combine debt and equity financing over a development period characterized by negative cash flows, followed by an operating period where sustainable cash flows support a relatively high degree of leverage. While private equity and real estate investment returns come from cash flows over a holding period and a terminal value upon exit, infrastructure equity investors must receive their returns largely in the form of dividends given the minimal or zero terminal value of most infrastructure assets. As the infrastructure asset's equity cushion declines, the ability to support debt financing falls, with debt repayment occurring earlier in the project life cycle, as shown in Exhibit 9.

Exhibit 9: Infrastructure Project BOT Investment Life Cycle



Once an infrastructure asset enters the operating phase, cash flows are used to pay debt service, operating and maintenance expenses, and other costs, after which funds are available to equityholders in the form of dividends. Given the limited growth options, limited opportunities for cash flow reinvestment, and contractual or regulated business model associated with infrastructure assets, most SPEs are characterized by a strict cash flow waterfall that dictates the prioritization and use of project cash flow to meet all obligations, as well as payments to debt- and equityholders, as shown in Exhibit 10.

Exhibit 10: Project SPV Sample Cash Flow Waterfall



The SPV's debt may in some cases be enhanced by the establishment of reserve accounts for debt service and other obligations. For example, when project cash flows are less predictable, a **debt service reserve account (DSRA)** is often established, which accumulates sufficient cash in order to meet specific debt service requirements and from

which funds are released when payments are due. Reserve accounts are often used for operating and maintenance costs and for decommissioning equipment at the end of its serviceable life. For example, the eventual closure and dismantling of a power generation facility and its equipment often involves a reserve account.

The roles of debt and equity financing in infrastructure projects can vary significantly depending on the business model, underlying industry, and public and private entities involved in a specific project. As with other private investments, such as real estate, debt investors often consider leverage and coverage measures to evaluate creditworthiness, such as **loan to value (LTV)** and the **debt service coverage ratio (DSCR)**, respectively:

$$\text{LTV} = \frac{\text{Debt outstanding}}{\text{Current project value}}. \quad (1)$$

$$\text{DSCR} = \frac{\text{Net cash flow from operations}}{\text{Debt service}}. \quad (2)$$

Equity investors, in contrast, evaluate before-tax returns using actual or expected net cash flow from operations minus debt service to establish an **equity dividend rate**:

$$\text{Equity dividend rate} = \frac{\text{Before} - \text{tax net cash flow}}{\text{Equity invested}}, \quad (3)$$

where:

$$\text{Before-tax cash flow} = \text{Net cash flow from operations} - \text{Debt service}. \quad (4)$$

Note that this equity return calculation rate does not include fees. Recall from earlier in the curriculum that GP fees (R_{GP}) often involve a fixed percentage (r_m) of AUM as a management fee on end-of-period assets (P_1) and a GP performance fee (p) as a percentage of total period return ($P_1 - P_0$) in excess of a hurdle rate (r_h):

$$R_{GP\,(\text{Net with hurdle})} = (P_1 \times r_m) + \max\left\{0, \left[P_1(1 - r_m) - P_0 \times (1 + r_h)\right] \times p\right\}. \quad (5)$$

The infrastructure investment process and use of debt and equity are similar to other private markets during the development and construction phases with varying degrees of public sector involvement, while the predefined operating period places constraints on the use of leverage.

For example, in the earlier case of the UK wind farm, Wyndside, the public sector stabilized project cash flows under the contract for difference scheme used to offset electricity price volatility. However, more complex, larger-scale projects in developing economies designed to address national economic priorities (such as Tay Bac Airport) often rely on direct and indirect financial incentives, subsidies, and/or guarantees from multilateral institutions, developed market governments, and private partners to attract additional foreign debt and equity investors.

CASE STUDY

TBA Limited Financing Plan

The Tay Bac Airport project involves the reclamation of a former military base and construction of a 3,200 meter runway, as well as a new passenger terminal with the initial capacity to serve 5 million passengers per year with retail and other services, auto rental, and rail and road transportation links (to be established by the Transport Ministry), as well as fueling, maintenance, and cargo handling facilities. Expected project development costs over three years are as follows:

TBA Development Costs	USD
Facilities	515,000,000
Equipment & Systems	135,000,000
On-Site Land Improvements	100,000,000
Civil Engineering	90,000,000
Parking & Transportation	50,000,000
Upfront Costs & Reserves	10,000,000
Total	900,000,000

Upon completion, TBA will hold a 20-year concession under which it is due to receive periodic contractual payments for operating passenger and cargo aviation services while holding the right to operate retail, parking, and other airport-based services under a commercial or merchant payment scheme based on demand and other economic factors.

TBA Project Financing Plan

Equity: 35% of cost, or USD315,000,000, 25% of which is from AviAlliance, with the remaining 75% from other equity investors drawn in three stages. GP performance fees upon completion are 10% of returns above a 15% hurdle.

Equity drawdown:

- Initial: USD157,500,000 (AviAlliance equity is fully drawn)
- One year: USD78,750,000
- Two years: USD78,750,000

Debt: 65% of cost, or USD585,000,000, from public and private investors:

1. International Finance Corporation (IFC) senior loan (USD150,000,000)
   - 6% annual interest
   - Fully disbursed at the end of Year 2 linked to project milestones
   - Accrued interest is capitalized in Year 3 and paid in Year 4 on full balance outstanding.
   - Loan is repaid in 12 equal annual installments comprising principal and interest payments starting in Year 5
   - Secured by TBA project assets
2. Senior syndicated bank loan—Term Loan A (USD235,000,000)
   - 7.5% annual interest paid annually on balance outstanding
   - Fully disbursed at the end of Year 3 linked to construction milestones
   - Full balance outstanding for three years, with principal amortization in four equal annual tranches thereafter
   - Secured by TBA project assets
3. Bank loan (ECA guaranteed; USD100,000,000)
   - 6.5% annual interest paid annually on outstanding balance
   - Fully disbursed at the end of Year 3 linked to export and delivery of ECA-eligible equipment and systems
   - Interest is paid on full balance outstanding for 10 years, with full (bullet) loan repayment at maturity.

- Insured by developed market ECA against political and commercial risks and secured by equipment financed under loan agreement

4. Junior construction and development loan (USD100,000,000)
   - 9.5% annual interest accrued on outstanding balance
   - Immediate disbursal upon project initiation and equity drawdown
   - Capitalized interest and principal are paid in four equal installments starting at the end of Year 14.
   - Subordinated claim to TBA project assets, which is repaid only once senior creditor claims are paid

TBA Operations

In its first full year of operation, Tay Bac Airport expects to earn an average of USD40 in per-passenger total airport revenue from 5 million passengers and before-tax cash flow based on the following assumptions:

Tay Bac Airport Operations	USD
Total Revenue (5,000,000 passengers × USD40 each)	200,000,000
Operating Expenses (40% of Revenue)	80,000,000
EBITDA	120,000,000
Capital Expenditures (CapEx)	20,000,000
Net Cash Flow from Operations	**100,000,000**

1. Calculate the debt outstanding and the DSCR for the first full year of operation (Year 4) of the Tay Bac Airport project.

   Solution:

   The debt service coverage ratio is equal to net cash flow from operations divided by debt service, as shown in Equation 2:

$$\text{DSCR} = \frac{\text{Net cash flow from operations}}{\text{Debt service}}.$$

   Net cash flow from the first year of operations is given as USD100,000,000, and we must solve for Year 4 debt service as follows:

   1. IFC senior loan (USD150,000,000)

      As 6% interest is capitalized in Year 3 and paid in Year 4 on the full balance, we may calculate Year 4 debt outstanding and debt service as follows:

      Debt outstanding: USD159,000,000 = USD150,000,000 × (1 + 0.06).

      Debt service: USD9,540,000 = USD159,000,000 × 0.06.

   2. Senior syndicated bank loan—Term Loan A (USD235,000,000)

      7.5% annual interest is paid, and the full balance is outstanding:

      Debt service: USD17,625,000 = USD235,000,000 × 0.075.

   3. Bank loan (ECA guaranteed; USD 100,000,000)

      6.5% annual interest is paid, and the full balance is outstanding:

      Debt service: USD6,500,000 = USD100,000,000 × 0.065.

   4. Junior construction and development loan (USD100,000,000)

While 9.5% annual interest is accrued on the outstanding balance, interest is capitalized and not paid until installments begin at the end of Year 10:

Debt outstanding: USD143,766,095 = USD100,000,000 × $(1 + 0.095)^4$

Debt service: USD0

Debt outstanding is the sum of the four loans outstanding at the end of Year 4:

USD637,766,095 = 159,000,000 + 235,000,000 + 100,000,000 + 143,766,095.

No debt amortization occurs in Year 4, so debt service is the sum of the interest payments on the four loans at the end of Year 4:

Debt service: USD33,665,000 = 9,540,000 + 17,625,000 + 6,500,000 + 0.

Solve for DSCR to be 2.97 as follows:

$$\text{DSC} = 2.97 = \frac{\text{USD } 100,000,000}{\text{USD } 33,665,000}.$$

2. Solve for the LTV at the end of Year 4 if the TBA project has a value that has appreciated 10% above its original development cost.

Solution:

Use Equation 1 to solve for loan to value as follows:

$$\text{LTV} = \frac{\text{Debt outstanding}}{\text{Current project value}}.$$

Given Tay Bac Airport development costs of USD900,000,000, we can solve for an estimated project value of USD990,000,000 (= 1.1 × 900,000,000):

$$\text{LTV} = 0.644 = \frac{637,766,095}{990,000,000}.$$

Note that while capitalized interest decreases debt service, it increases LTV.

3. Calculate the equity dividend rate for the first full year of TBA's operation, as well as the GP performance fee (ignoring management fees).

Solution:

Using TBA's Year 4 debt service of USD33,665,000 from Question 1, solve for before-tax cash flow of USD66,335,000 using Equation 4:

Before-tax cash flow = Net cash flow from operations – Debt service

= 100,000,000 – 33,665,000.

Use Equation 3 to solve for the equity dividend rate by dividing before-tax cash flow by project equity.

$$\text{Equity dividend rate} = 21.1\% = \frac{\text{USD66,335,000}}{\text{USD315,000,000}}.$$

GP performance fees are equal to 10% of the equity dividend rate in excess of the 15% hurdle rate. We may use a simplified version of Equation 5 (where $r_m = 0$) to solve for the performance fee as follows:

$$R_{GP\ (\text{Net with hurdle})} = (P_1 \times r_m) + \max\{0, [P_1(1 - r_m) - P_0 \times (1 + r_h)] \times p\}.$$

$$R_{GP\ (\text{Net with hurdle},\ r_m=0)} = \max\{0, [P_1 - P_0 \times (1 + r_h)] \times p\}.$$

P_1 is equal to USD381,335,000, or the sum of the equity dividend and equity, with r_h of 0.15 and p of 0.10:

$$= \max\{0, [381,335,000 - 315,000,000 \times (1.15)] \times 0.1\},$$

which results in a GP performance fee of USD1,908,500.

QUESTION SET

The 125 MW Vento Anglio Limited (VAL) project involves the purchase and installation of 50 2.5 MW wind turbines at a cost of GBP1.1million per MW, with total development costs incurred either upfront or equally over three years, as follows:

VAL Development Costs	GBP
Wind Turbines & Related Costs	137,500,000
Contingency Reserve	6,500,000
Operating Deficit Reserves	4,255,000
Interest Reserves	4,020,000
Development Fees	2,300,000
Misc. Closing Costs	2,000,000
Land Use Cost	1,825,000
Site Setup Costs	1,600,000
Total	160,000,000

VAL turbines have a 30-year serviceable life, and VAL plans to contract with LCCC for fixed-price delivery under a 15-year CfD agreement when operations begin. Note that while wind power generation in practice often varies due to changing weather conditions over time and other factors, the wind farm capacity used for VAL modeling purposes is a probability-weighted measure of a minimal level for each wind turbine to produce over an average year with 90% probability, referred to in the renewable energy industry as a **P90 level**.

VAL Project Financing Plan

Equity: 31.25% of cost, or GBP50,000,000 drawn in three steps. Upon completion, GP performance fees are 15% of returns above a 12% hurdle rate.

Equity drawdown:

- Initial: GBP20,000,000
- One year: GBP15,000,000
- Two years: GBP15,000,000

Debt: 68.75% of cost, or GBP110,000,000 from private investors in two forms:

Construction and development (C&D) loan

- 8% annualized interest

- Monthly loan disbursements linked to construction milestones, such as site setup and timely commissioning of wind turbines as scheduled
- Interest accrues monthly over a three-year construction period.
- Secured by VAL land, equipment, and other project assets
- 36 end-of-month drawdowns (disbursements) equal to GBP2,725,108 each
- Loan is to be repaid from amortizing term loan proceeds.

Amortizing term loan

- 15-year, GBP110,000,000 amortizing loan starting in three years
- Drawn once 125 MW are fully operational and connected to grid
- 7% annual interest rate with 180 fixed monthly payments of interest and principal repayment
- Secured by VAL land, equipment, and other project assets

VAL Operations

VAL's expected revenue from its first full year of operation is shown in the following table.

Measure	Amount
Wind Farm Capacity (MW)	125
P90 Farm Capacity (kWh, 1,000 kW = 1 MW) (Wind Farm Capacity for 8,760 Hours)	1,095,000,000
Efficiency (%)	35%
Total Output (kWh)	383,250,000
Down Time (%)	5%
Actual Output (kWh)	364,087,500
Fixed Price for Delivery (GBP/kWh)	0.125
First Full Year of Revenue (GBP)	45,510,938
Operating Expenses (GBP)	(9,715,082)
Net Cash Flow from Operations (GBP)	**35,795,855**

VAL turbines are assumed to be 35% efficient in capturing wind power. With 5% expected down time and a starting contractual rate of GBP0.125 per kWh, first-year estimated revenue is GBP45,510,938 (= 125MW × 1,000 kWh/MW × 8,760 hours/year × 35% efficiency × 95% operating time × GBP0.125).

1. Calculate and show the ratio of equity to total capital monthly for the first year of the VAL project.

   Solution:

   Equity drawdown of GBP20,000,000 occurs at inception and does not occur again until the beginning of the second year, while C&D debt outstanding at month end is the sum of the loan drawdown to date and interest accrued on the initial period balance at the monthly equivalent of an 8% annual rate. Recall from earlier time-value-of-money lessons that this may be converted to a monthly rate as follows:

   $$R_{annual} = \left(1 + R_{monthly}\right)^{12} - 1;$$

$R_{monthly} = 0.6434\% = (1 + 0.08)^{1/12} - 1.$

Therefore, at the end of Month 2, the outstanding C&D loan balance is equal to GBP5,467,750, calculated as follows:

- GBP2,725,108 drawn at the end of Month 1
- GBP17,533 interest on initial balance (= 0.6434% × 2,725,108)
- GBP2,725,108 drawn at the end of Month 2
- GBP5,467,750 = 2,725,108 + 17,533 + 2,725,108.

Use an Excel spreadsheet or Google Sheet to calculate monthly debt and equity balances. The following table provides a summary for the first 12 months.

Month	C&D Loan Drawdown	C&D Interest	C&D Loan Balance	Equity	Total	Equity/ (Debt + Equity)
1	2,725,108	0	2,725,108	20,000,000	22,725,108	0.88
2	2,725,108	17,533	5,467,750	20,000,000	25,467,750	0.79
3	2,725,108	35,180	8,228,038	20,000,000	28,228,038	0.71
4	2,725,108	52,939	11,006,086	20,000,000	31,006,086	0.65
5	2,725,108	70,813	13,802,007	20,000,000	33,802,007	0.59
6	2,725,108	88,803	16,615,918	20,000,000	36,615,918	0.55
7	2,725,108	106,907	19,447,934	20,000,000	39,447,934	0.51
8	2,725,108	125,129	22,298,170	20,000,000	42,298,170	0.47
9	2,725,108	143,467	25,166,746	20,000,000	45,166,746	0.44
10	2,725,108	161,924	28,053,778	20,000,000	48,053,778	0.42
11	2,725,108	180,499	30,959,385	20,000,000	50,959,385	0.39
12	2,725,108	199,194	33,883,687	20,000,000	53,883,687	0.37

2. Calculate the LTV at the end of 12 months if the project's value equals cost in terms of debt and equity.

Solution:

Use Equation 1 to solve for LTV at the end of 12 months as follows:

LTV= 0.63 = 33,883,687/53,883,687.

Note that LTV equals 1 – [Equity/(Debt + Equity)] in the solution to Question 1.

3. Calculate the DSCR *for the first year after completion* using VAL's expected first full year of revenue.

Solution:

To determine DSCR upon completion, we must solve for the fixed monthly mortgage loan payment. Earlier fixed-income learning modules showed that periodic payments (A) for a fully amortizing loan may be calculated as follows:

$$A = \frac{r \times \text{Principal}}{1 - (1 + r)^{-n}},$$

where

A = Periodic payment

r = Interest rate per period (0.07/12)

Principal = Principal amount (GBP110,000,000)

n = Number of periods (180 = 15 × 12)

Solve for A of GBP988,711 per month as follows:

$$A = \text{GBP}988,711 = \frac{0.005833 \times \text{GBP}110,000,000}{1 - (1 + 0.07/12)^{-180}}.$$

We may also derive A using the Excel PMT function PMT(rate, nper, pv, [fv], [type]), giving us an answer of –GBP988,711 using PMT(0.07/12, 180, 110000000, 0, 0). The final entry of zero indicates that the amortizing term loan settles at the end of the period.

Annual debt service is therefore GBP11,864,533 (= 988,711 × 12).

Solving for DSCR gives 3.02 using Equation 2 and net cash flow from operations of GBP35,795,855 from above as follows:

DSCR = Net cash flow from operations/Debt service.

DSCR = 3.02 = GBP35,795,855/GBP11,864,533.

4. Calculate the equity dividend rate for the first full year of VAL's operation and the GP performance fee (ignoring management fees).

Solution:

Using VAL's annual debt service of GBP11,864,533 from Question 2, solve for before-tax cash flow of GBP23,931,322 using Equation 4:

Before-tax cash flow = Net cash flow from operations – Debt service.

GBP23,931,322 = 35,795,855 – 11,864,533.

Use Equation 3 to solve for the equity dividend rate:

$$\text{Equity dividend rate} = 47.9\% = \frac{\text{GBP}23,931,322}{\text{GBP}160,000,000 - \text{GBP}110,000,000}.$$

GP performance fees are equal to 15% of the equity dividend rate in excess of the 12% hurdle rate. Solve as before using a simplified version of Equation 5:

$$R_{GP\,(\text{Net with hurdle, } r_m=0)} = \max\{0, [P_1 - P_0 \times (1 + r_h)] \times p\}.$$

P_1 is equal to GBP73,931,322, or the sum of the equity dividend and equity, with r_h of 0.12 and p of 0.15:

$$= \max[0, (73,931,322 - 50,000,000 \times 1.12) \times 0.15],$$

which results in a GP performance fee of GBP2,689,968.

INFRASTRUCTURE INVESTMENT DUE DILIGENCE AND VALUATION

5

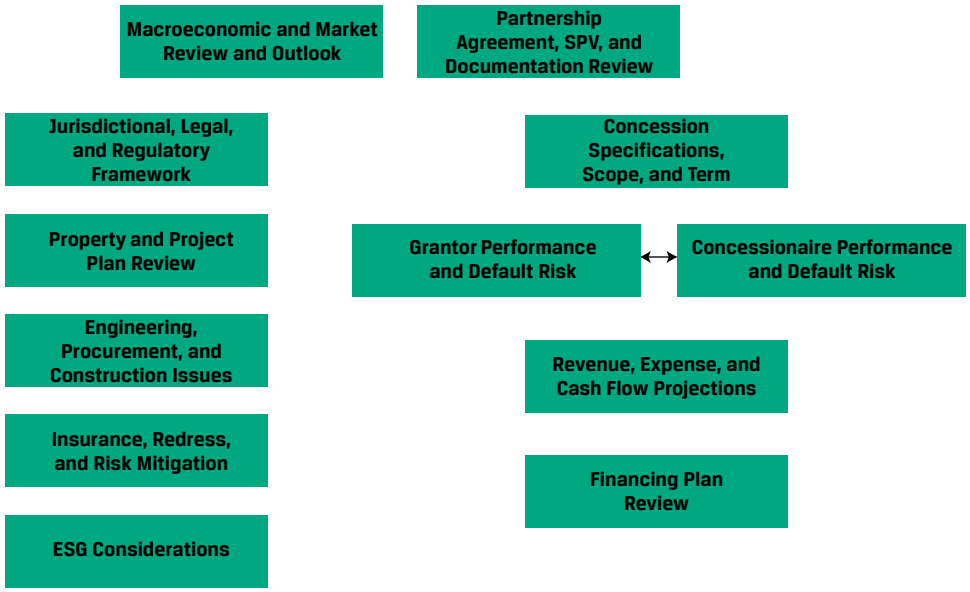
- ☐ discuss the due diligence and valuation processes for infrastructure investments

Infrastructure Investment Due Diligence

Infrastructure investments are distinguished by their greater complexity and longevity relative to other assets. Investors often develop or engage advisers with specific legal and sector-specific technical expertise to conduct due diligence.

In addition to specific jurisdictional, legal, and regulatory considerations, detailed technical issues associated with engineering, procurement, and construction contracts, as well as the details, scope, and commercial terms of the concession agreement, are among the unique elements of infrastructure due diligence, as highlighted in Exhibit 11.

Exhibit 11: Elements of Infrastructure Investment Due Diligence



As in the case of other private markets, investors use a variety of sources to gather information about factors affecting the asset's future economic use, including forecasting demand and long-term growth. In private equity or real estate, asset appreciation over a several-year period of restructuring or development drives a greater focus on the market or real estate cycle. Infrastructure investors, in contrast, seek to ensure the protection of a project's long-term viability over multiple cycles with a greater focus on both jurisdictional and legal issues, as well as performance and default risk of the multiple parties involved. Three key areas of importance for infrastructure due diligence are highlighted next.

Jurisdictional, Legal and Regulatory Framework

The direct and indirect involvement of public authorities in infrastructure projects requires a broad knowledge of host country laws and a detailed understanding of regulations specifically pertaining to a project's grantor of property use, the right to construct and operate the asset under an associated concession, and key commercial terms. In particular, the legal status of the grantor and laws governing its authority, the means of dispute resolution, and possible sovereign immunity issues are considerations for investors to factor into their analysis.

Lenders must also thoroughly investigate financial recourse, such as the ability to assume control or take possession of project assets, cash reserve accounts, insurance proceeds, or other assets, as well as the right to take corrective action via negative covenants or other means when a project is in trouble.

When investing in developing markets, investors also consider the degree of technical and financial support from global or supranational financial institutions, governments, and globally active developers and operators, as well as the existence of currency controls or limitations on the repatriation of returns or capital investments.

Compliance with anti-corruption laws, ESG issues, and reputational risk issues also require evaluation.

Engineering, Procurement, and Construction Contract Issues

Investors must evaluate both a project's technical feasibility to meet service needs over the anticipated contract life and its adherence to legal and regulatory requirements. Engineering, design, and construction plans must be comprehensive and achievable by project developers and must meet all safety and regulatory requirements (both local and international standards). Reasonable project cost estimates must be combined with a realistic timeline that incorporates time required for permits and approvals, as well as potential delays, risks, and contingencies. Investors must also understand the likelihood and consequences of cost overruns and project delays.

Procurement and contracting arrangements for the project must follow specific guidelines and regulations, such as local labor laws; address the potential environmental and community impact; and comply with zoning and land use regulations. Investors must review procurement strategy, evaluate contracts and sub-contracts, and assess the reputation, track record, and financial stability of developers and contractors.

Concession Scope, Specifications, and Term

Beyond the broad distinction among fixed or availability-based, commercial, or regulation-based payment schemes outlined earlier, investors must thoroughly understand the specific size and timing of revenue flows, as well as any contingencies. For example, the concessionaire may be required to meet specific maintenance or operating standards to be fully compensated. The concessionaire may also be required to renew or upgrade assets or increase capacity as the concession term nears its end.

In other cases, total project receipts do not cover operating costs or additional investments, requiring the grantor to establish alternative forms of cost recovery, including subsidies, taxes, or other government sources. Consider the challenges faced by the new Berlin airport, which we will describe next.

BERLIN BRANDENBURG AIRPORT

Because Berlin's existing three airports lacked the capacity to meet expected future air traffic demand for the country's new capital, a new single airport, Berlin Brandenburg Airport, was proposed to expand capacity following German reunification in 1990.

After establishing a project company in 1991, federal, state, and local authorities reached a consensus on using one of the existing airports (Schönefeld) as the site for the new project over a five-year period.

Originally planned as a privately constructed and operated airport over a 50-year concession period, the initial consortium selected to build and operate the new airport was removed due to legal action by a losing bidder, and ultimately the privatization effort was abandoned in 2003.

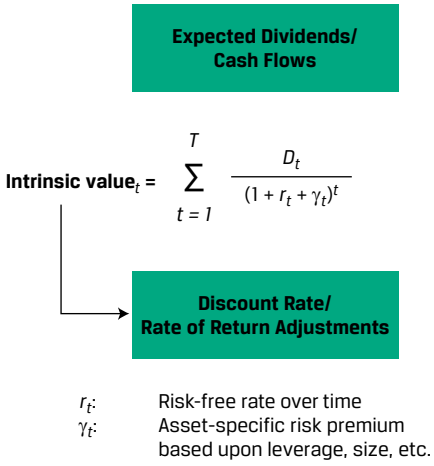
Once the project shifted to the public sector, legal action by nearby residents adversely impacted by the airport expansion delayed the start of construction until 2006. Although the Berlin Brandenburg Airport was slated to open in 2011, five years after construction began, substantial cost overruns and poor construction planning, execution, and management led to nearly a decade of further delays, with the airport finally opening for commercial traffic in October 2020, nearly 30 years after official planning began. Over this period, the project planner became insolvent, the architectural firm was dismissed, and a host of technical and engineering problems arose over the construction period, from faulty wiring to an inadequate fire safety system.

Infrastructure Investment Valuation

Earlier learning modules have demonstrated the use of public market valuation approaches, such as discounted cash flow, relative value, or replacement cost methods, in private markets, which have varying degrees of applicability and typically require several adjustments among different asset classes.

In the case of private infrastructure assets, the preferred method is the discounted cash flow (DCF) approach with periodic equity distributions in the form of dividends (D_t) in the numerator and a series of discount rates in the denominator combining risk-free rates (r_t) with an asset-specific risk premium (γ_t) comprising relevant risk factors, as shown in Exhibit 12 and Equation 5.

Exhibit 12: Areas of Focus for Infrastructure Asset Valuation



$$\text{Intrinsic value} = \sum_{t=1}^{T} \frac{D_t}{(1 + r_t + \gamma_t)^t}, \quad (6)$$

$$\gamma_t = \text{Risk factor}_{1,t} + \text{Risk factor}_{2,t} + \ldots; \gamma = \sum_{k=1}^{K} Risk\ factor_{k,t} \quad (7)$$

The predominant use of the DCF method is also often due to a lack of comparable infrastructure asset transactions severely limiting the application of relative value techniques, while the alternative of a replacement cost approach ignores a project's underlying business model, source of cash flows, and life cycle timing.

The Tay Bac Airport case study continues with expected cash flows for the project.

CASE STUDY

Tay Bac Airport Expected Cash Flows

Meg Zhu is a senior analyst at InfraEast, an infrastructure firm considering an investment in the Tay Bac Airport project. She notes the expected USD200,000,000 in initial operating year (Year 4) revenue from 5,000,000 passengers generating USD40 in gross revenue each. Based on her analysis of expected Vietnamese economic growth and existing airport cost structures, Zhu formulates the following assumptions to project future cash flows:

- For the first 10 years of operation (through Year 13), Tay Bac Airport passenger traffic grows 5% annually while revenue per passenger rises 1% per year. Starting in the 11th year of operation (Year 14) through the end of the concession period, the respective growth rates fall by 50%.
- Zhu estimates operating and other expenses equal to 50% of revenue and assumes a tax rate of 20%.

Zhu next uses the following debt details to determine annual debt service:

IFC Senior Debt

Year	Drawdown	Interest Accrued	Interest Paid	Principal Paid	Debt Service	Debt Outstanding
2	150,000,000					150,000,000
3		9,000,000				159,000,000
4		9,540,000	9,540,000		**9,540,000**	159,000,000
5		9,540,000	9,540,000	9,425,048	**18,965,048**	149,574,952
6		8,974,497	8,974,497	9,990,551	**18,965,048**	139,584,402
7		8,375,064	8,375,064	10,589,984	**18,965,048**	128,994,418
8		7,739,665	7,739,665	11,225,383	**18,965,048**	117,769,036
9		7,066,142	7,066,142	11,898,906	**18,965,048**	105,870,130
10		6,352,208	6,352,208	12,612,840	**18,965,048**	93,257,290
11		5,595,437	5,595,437	13,369,610	**18,965,048**	79,887,680
12		4,793,261	4,793,261	14,171,787	**18,965,048**	65,715,893
13		3,942,954	3,942,954	15,022,094	**18,965,048**	50,693,799
14		3,041,628	3,041,628	15,923,420	**18,965,048**	34,770,379
15		2,086,223	2,086,223	16,878,825	**18,965,048**	17,891,554
16		1,073,493	1,073,493	17,891,554	**18,965,048**	

Senior Term Loan A

Year	Drawdown	Interest Paid	Principal Paid	Debt Service	Debt Outstanding
3	235,000,000				235,000,000
4		17,625,000		**17,625,000**	235,000,000
5		17,625,000		**17,625,000**	235,000,000
6		17,625,000		**17,625,000**	235,000,000
7		17,625,000	58,750,000	**76,375,000**	176,250,000
8		13,218,750	58,750,000	**71,968,750**	117,500,000
9		8,812,500	58,750,000	**67,562,500**	58,750,000
10		4,406,250	58,750,000	**63,156,250**	

Bank Loan (ECA guaranteed)

Year	Drawdown	Interest Paid	Principal Paid	Debt Service	Debt Outstanding
3	100,000,000				100,000,000
4		6,500,000		6,500,000	100,000,000
5		6,500,000		6,500,000	100,000,000
6		6,500,000		6,500,000	100,000,000
7		6,500,000		6,500,000	100,000,000
8		6,500,000		6,500,000	100,000,000
9		6,500,000		6,500,000	100,000,000
10		6,500,000		6,500,000	100,000,000
11		6,500,000		6,500,000	100,000,000
12		6,500,000		6,500,000	100,000,000
13		6,500,000	100,000,000	106,500,000	

Junior Debt

Year	Drawdown	Interest Accrued	Interest Paid	Principal Paid	Debt Service	Debt Outstanding
0	100,000,000					100,000,000
1		9,500,000				109,500,000
2		10,402,500				119,902,500
3		11,390,738				131,293,238
4		12,472,858				143,766,095
5		13,657,779				157,423,874
6		14,955,268				172,379,142
7		16,376,019				188,755,161
8		17,931,740				206,686,901
9		19,635,256				226,322,156
10		21,500,605				247,822,761

Year	Drawdown	Interest Accrued	Interest Paid	Principal Paid	Debt Service	Debt Outstanding
11		23,543,162				271,365,924
12		25,779,763				297,145,686
13		28,228,840				325,374,527
14		30,910,580	30,910,580	70,626,722	**101,537,352**	254,747,755
15		24,201,037	24,201,037	77,335,315	**101,537,352**	177,411,440
16		16,854,087	16,854,087	84,683,265	**101,537,352**	92,728,175
17		8,809,177	8,809,177	92,728,175	**101,537,352**	0

1. Calculate the expected Tay Bac Airport revenue, net cash flow from operations, and after-tax dividend over the 20-year concession period.

Solution:

Using the assumptions provided, we can determine TBA's annual revenue. Initial operating (Year 4) revenue of USD200,000,000 grows at an annual rate of 6.05% [= (1.05 × 1.01) – 1] through Year 13 and 3.515% [= (1.025 × 1.005) – 1] thereafter. For example, Year 5 operating revenue is USD212,100,000, or 200,000,000 × 1.05 × 1.01.

Net cash flow from operations is half of revenue. Using the previous debt service analysis and Equation 4,

Before-tax cash flow = Net cash flow from operations – Debt service,

we can solve for before-tax cash flow, which when reduced by the 20% tax rate gives us the after-tax dividend. These figures are summarized for the full concession period as follows:

Year	Revenue	Net Cash Flow from Operations	Debt Service	Interest Payments	Before-Tax Cash Flow	Tax	After-Tax Dividend
4	200,000,000	100,000,000	33,665,000	33,665,000	66,335,000	13,267,000	53,068,000
5	212,100,000	106,050,000	43,090,048	33,665,000	62,959,952	14,477,000	48,482,952
6	224,932,050	112,466,025	43,090,048	33,099,497	69,375,977	15,873,306	53,502,672
7	238,540,439	119,270,220	101,840,048	32,500,064	17,430,172	17,354,031	76,141
8	252,972,136	126,486,068	97,433,798	27,458,415	29,052,270	19,805,531	9,246,740
9	268,276,950	134,138,475	93,027,548	22,378,642	41,110,927	22,351,967	18,758,961
10	284,507,705	142,253,853	88,621,298	17,258,458	53,632,555	24,999,079	28,633,476
11	301,720,421	150,860,211	25,465,048	12,095,437	125,395,163	27,752,955	97,642,208
12	319,974,507	159,987,253	25,465,048	11,293,261	134,522,206	29,738,799	104,783,407
13	339,332,965	169,666,482	125,465,048	10,442,954	44,201,435	31,844,706	12,356,729
14	349,555,370	174,777,685	120,502,399	33,952,208	54,275,286	28,165,095	26,110,190
15	360,085,726	180,042,863	120,502,399	26,287,259	59,540,463	30,751,121	28,789,343
16	370,933,308	185,466,654	120,502,399	17,927,580	64,964,255	33,507,815	31,456,440
17	382,107,674	191,053,837	101,537,352	8,809,177	89,516,485	36,448,932	53,067,553
18	393,618,668	196,809,334			196,809,334	39,361,867	157,447,467
19	405,476,430	202,738,215			202,738,215	40,547,643	162,190,572
20	417,691,408	208,845,704			208,845,704	41,769,141	167,076,563
21	430,274,361	215,137,181			215,137,181	43,027,436	172,109,744

Year	Revenue	Net Cash Flow from Operations	Debt Service	Interest Payments	Before-Tax Cash Flow	Tax	After-Tax Dividend
22	443,236,376	221,618,188			221,618,188	44,323,638	177,294,551
23	456,588,872	228,294,436			228,294,436	45,658,887	182,635,549

2. Contrast the risks of the Senior Term Loan A and the junior debt tranches in the context of TBA's debt profile and project phases.

   Solution:

   While Term Loan A interest and principal reflect a senior debt claim, the greater risks of the junior debt tranche are reflected in the fact that it is drawn earlier (Year 0 versus Year 3 in the case of Term Loan A), remains fully outstanding during TBA's construction and development phase, is repaid later (Years 13–17 for junior debt, Years 7–10 for Term Loan A), pays no interest until amortization, represents a subordinated claim to TBA project assets, and is repaid only once periodic debt service for the other three loans is paid.

   Junior debt repayment occurs following the expected initial revenue growth phase of the project—that is, during a period after which the growth in the number of passengers and revenue per passenger has leveled off.

3. Discuss the project period or periods in which TBA is at greatest risk of being unable to meet its debt service.

   Solution:

   The debt service coverage ratio, shown in Equation 2, provides a measure of whether the project is able to meet its debt obligations from expected net cash flow from operations:

$$\text{DSCR} = \frac{\text{Net cash flow from operations}}{\text{Debt service}}.$$

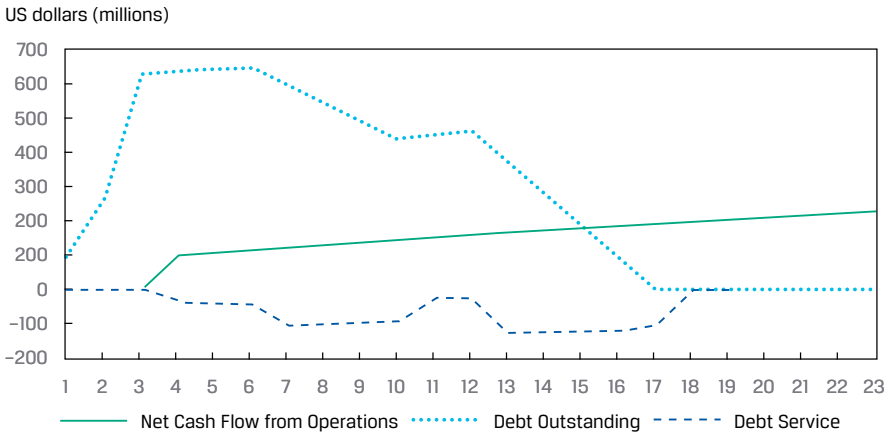
   As demonstrated in the following table, the project's DSCR is expected to reach a low of 1.17X in Year 7 as the amortization of Term Loan A begins. Note that the DSCR also remains relatively low (below 2X) during the years when Term Loan A principal is amortized (Years 7–10) and when the bank ECA loan and the junior loan are amortized (Years 13–17).

Year	Net Cash Flow from Operations	Debt Service	DSCR
4	100,000,000	33,665,000	2.97
5	106,050,000	43,090,048	2.46
6	112,466,025	43,090,048	2.61
7	119,270,220	101,840,048	1.17
8	126,486,068	97,433,798	1.30
9	134,138,475	93,027,548	1.44
10	142,253,853	88,621,298	1.61
11	150,860,211	25,465,048	5.92
12	159,987,253	25,465,048	6.28
13	169,666,482	125,465,048	1.35
14	174,777,685	120,502,399	1.45
15	180,042,863	120,502,399	1.49

Year	Net Cash Flow from Operations	Debt Service	DSCR
16	185,466,654	120,502,399	1.54
17	191,053,837	101,537,352	1.88
18	196,809,334		
19	202,738,215		
20	208,845,704		
21	215,137,181		
22	221,618,188		
23	228,294,436		

As illustrated in the case study, infrastructure projects often make use of multiple sources of public and private debt to optimize the cost and timing of debt service and outstanding debt over the project life cycle. These relationships are shown with net cash flow from operations in Exhibit 13.

Exhibit 13: Tay Bac Cash Flows and Debt



The IFC and ECA loans reduce debt costs compared to traditional private market sources. The senior term loan market has relatively standardized terms, while the junior loan offers private investors higher return in exchange for subordinated claims, capitalized interest, and full drawdown over the construction phase combined with a longer tenor.

The denominator used to discount infrastructure asset cash flows involves a combination of the term structure of risk-free rates and an asset-specific risk premium. Note that these risk premiums may vary over time based on changes over the project life cycle and market conditions. As in the case of private company valuation, the limited applicability of the capital asset pricing model using public company comparables results in the use of a buildup approach that combines a number of risk factors:

- *Size:* Larger infrastructure assets are less liquid, and therefore a higher liquidity premium is associated with owning such assets. This factor typically rises under adverse market conditions when investors seek greater liquidity.

- *Leverage:* While higher leverage generally commands a higher risk premium, falling leverage ratios over the life of an infrastructure project contribute to lower future discount rates. Note also that projects with a contractual, fixed cash flow business model are often able to support greater leverage than those with merchant payment schemes.
- *Profitability:* Profitability is inversely related to risk and is often believed to have a smaller impact on the discount rate than other factors. Higher profits lead to a lower and typically negative risk premium (that is, they receive less of a discount via a lower denominator in Equation 5), while lower profits have a higher risk premium.
- *Investment:* High capital expenditures as a proportion of project assets typically indicate an asset in the development phase of its life cycle, which is associated with the highest risk. This factor tends to be higher for greenfield investments than for brownfield investments.
- *Country risk:* As in the case of equities or other private assets, developing markets have higher project risk than do developed markets.
- *Currency risk:* If long-term project cash flows are in a foreign currency and remain unhedged, then a currency risk premium should be incorporated to address the risk of depreciation in the foreign currency cash flows and its impact on investor currency returns.

These aggregated risk factors are combined with each respective risk-free rate to derive a periodic discount rate used for valuation purposes as shown in the case of Tay Bac Airport.

CASE STUDY

Tay Bac Airport Discount Factors and Valuation

Meg Zhu at InfraEast continues her analysis of the Tay Bac Airport project at the end of Year 3 by estimating annual discount factors for the expected annual dividends to equityholders. As a first step, she observes the following US dollar risk-free zero rates that apply at the end of each period.

Year	US Dollar Risk-Free Zero Rates
4	3.0960%
5	3.2040%
6	3.2310%
7	3.2760%
8	3.3390%
9	3.4110%
10	3.4560%
11	3.5190%
12	3.6090%
13	3.7395%
14	3.8070%
15	3.9339%
16	4.0482%
17	4.1418%
18	4.2453%
19	4.3407%

Year	US Dollar Risk-Free Zero Rates
20	4.4568%
21	4.5216%
22	4.5459%
23	4.5657%

Next, Zhu analyzes the project in the context of key risk factors compared with transaction prices. Using a statistical analysis of past price observations and the key risk factors listed previously, she draws the following conclusions:

- *Size:* As a regional airport, Zhu considers Tay Bac Airport to be a mid-size project, which warrants a 1.50% risk premium above the risk-free rate over the project life.
- *Leverage:* Zhu assigns the highest (2.50%) project leverage risk premium for Years 4–6, which, given significant debt reduction due to amortization of Term Loan A and the maturing ECA bank loan, is reduced to 1.50% for Year 7 through Year 13. Zhu assigns a 0.50% leverage premium to Years 14 through 17 and 0.00% thereafter because debt will have been repaid.
- *Profitability and investment:* Tay Bac Airport's expected median profitability and relatively low investment levels (once construction is completed in the first three years) warrant a –1.00% and 0.50% risk premium adjustment, respectively.
- *Country and Currency Risk:* Based on Vietnam's status as a thriving middle-income economy and positive outlook, Zhu estimates the country risk for Vietnam to be a constant 4% throughout the concession period. Given that project cash flows are primarily in Vietnamese dong (VND) while financing is denominated in US dollars and the currency risk is unhedged, Zhu increases the risk premium by 1% based on potential future VND depreciation risk.

1. Calculate the respective annual discount rates for the Tay Bac Airport project concession period based on Meg Zhu's research.

Solution

We can solve for the respective annual discount rate by adding the risk-free zero rate, r_t, to the sum of the risk factors, γ_t, as shown in Equation 7:

$$\gamma_t = \text{Risk factor}_{1,t} + \text{Risk factor}_{2,t} + \ldots.$$

The respective discount factors ($r_t + \gamma_t$) are shown in the far right column in the following table:

Year	US Dollar Risk-Free Zero Rates	Size	Leverage	Profitability	Investment	Country and Currency Risk	Discount Factor ($r_t + \gamma_t$)
4	3.0960%	1.50%	2.50%	–1.00%	0.50%	5.00%	11.5960%
5	3.2040%	1.50%	2.50%	–1.00%	0.50%	5.00%	11.7040%
6	3.2310%	1.50%	2.50%	–1.00%	0.50%	5.00%	11.7310%
7	3.2760%	1.50%	1.50%	–1.00%	0.50%	5.00%	10.7760%
8	3.3390%	1.50%	1.50%	–1.00%	0.50%	5.00%	10.8390%
9	3.4110%	1.50%	1.50%	–1.00%	0.50%	5.00%	10.9110%
10	3.4560%	1.50%	1.50%	–1.00%	0.50%	5.00%	10.9560%

Year	US Dollar Risk-Free Zero Rates	Size	Leverage	Profitability	Investment	Country and Currency Risk	Discount Factor ($r_t + \gamma_t$)
11	3.5190%	1.50%	1.50%	–1.00%	0.50%	5.00%	11.0190%
12	3.6090%	1.50%	1.50%	–1.00%	0.50%	5.00%	11.1090%
13	3.7395%	1.50%	1.50%	–1.00%	0.50%	5.00%	11.2395%
14	3.8070%	1.50%	0.50%	–1.00%	0.50%	5.00%	10.3070%
15	3.9339%	1.50%	0.50%	–1.00%	0.50%	5.00%	10.4339%
16	4.0482%	1.50%	0.50%	–1.00%	0.50%	5.00%	10.5482%
17	4.1418%	1.50%	0.50%	–1.00%	0.50%	5.00%	10.6418%
18	4.2453%	1.50%	0.00%	–1.00%	0.50%	5.00%	10.2453%
19	4.3407%	1.50%	0.00%	–1.00%	0.50%	5.00%	10.3407%
20	4.4568%	1.50%	0.00%	–1.00%	0.50%	5.00%	10.4568%
21	4.5216%	1.50%	0.00%	–1.00%	0.50%	5.00%	10.5216%
22	4.5459%	1.50%	0.00%	–1.00%	0.50%	5.00%	10.5459%
23	4.5657%	1.50%	0.00%	–1.00%	0.50%	5.00%	10.5657%

2. Solve for the expected Tay Bac Airport project value at the end of Year 3.

Solution:

We can calculate the expected Tay Bac Airport project value at the end of Year 3 by first determining the present value (PV) of each annual dividend using the respective periodic discount rate and then adding the results. For example, because the Year 5 dividend is expected in two years, we solve for the PV of the Year 5 dividend as follows:

$$\text{USD}38,855,420 = \frac{\text{USD}48,482,952}{(1 + 0.11704)^2}.$$

The results for all expected concession period dividends are shown in the following table.

Year	Adjusted Rate	Discount Factor $(1 + r + y)^{-(t-3)}$	After-Tax Dividend	PV of After-Tax Dividend
4	11.596%	0.89609	53,068,000	47,553,676
5	11.704%	0.80142	48,482,952	38,855,420
6	11.731%	0.71693	53,502,672	38,357,864
7	10.776%	0.66408	76,141	50,563
8	10.839%	0.59777	9,246,740	5,527,460
9	10.911%	0.53722	18,758,961	10,077,691
10	10.956%	0.48300	28,633,476	13,829,884
11	11.019%	0.43333	97,642,208	42,311,566
12	11.109%	0.38749	104,783,407	40,602,181
13	11.240%	0.34467	12,356,729	4,259,055
14	10.307%	0.33991	26,110,190	8,875,161
15	10.434%	0.30393	28,789,343	8,749,895
16	10.548%	0.27154	31,456,440	8,541,572
17	10.642%	0.24273	53,067,553	12,881,303
18	10.245%	0.23153	157,447,467	36,453,096
19	10.341%	0.20712	162,190,572	33,593,391

Year	Adjusted Rate	Discount Factor $(1 + r + y)^{-(t-3)}$	After-Tax Dividend	PV of After-Tax Dividend
20	10.457%	0.18439	167,076,563	30,806,599
21	10.522%	0.16518	172,109,744	28,428,668
22	10.546%	0.14883	177,294,551	26,386,709
23	10.566%	0.13415	182,635,549	24,500,611

Next, we use Equation 6 to determine the expected project value:

$$\text{USD}460,642,367 = \sum_{t=4}^{23} (\text{PV of after} - \text{tax dividend})_t.$$

3. Discuss the return to equityholders over the construction period.

Solution:

During the construction period (Years 1 – 3), equity investors contribute capital into the project while the asset is generating no positive cash flows. So, there is no cash yield earned during the construction period. The return to equityholders is estimated on the basis of the expected future cash flows occurring over the 20-year life of the project beginning in Year 4. As shown in the solution to the prior question, the value of the project at the end of Year 3 is USD460,642,367, and we can calculate a project internal rate of return (IRR) of 13.51% using the initial equity investment of USD315,000,000 and a three-year period. This can be calculated using the IRR function on a financial calculator or using the Excel RATE formula as follows:

Project return = RATE(nper, pmt, -pv, fv)

= 13.51% = RATE(3, 0, -315000000, 460642367).

While the previous example represents the analyst's base-case estimate of project value, uncertainty over an infrastructure project's life cycle often warrants the use of **scenario analysis** or **sensitivity analysis**, as in the case of other private market investments. Recall that scenario analysis involves the combination of a base case with more favorable or adverse alternative outcomes to determine expected value using the average of scenario values weighted by their respective probabilities, while sensitivity analysis measures the impact of changes in one or more key variables on investment value.

Scenario analysis is of particular importance when structural or regulatory changes can lead to an abrupt shift in an infrastructure project's economic return. For example, the value of long-lived power generation projects based on fossil fuels may be impaired by policy changes discouraging the use of fossil fuels in response to climate change or increased operating costs due to enhanced regulatory measures to protect the environment. However, a future reduction in subsidies or less favorable terms for stabilized pricing mechanisms, such as CfDs, may adversely impact the return on long-lived renewable energy projects. Note that infrastructure investments are often viewed as providing an inflation hedge because of the ability of these assets to generate additional revenues during inflationary periods.

Sensitivity analysis is frequently used as a valuation tool in the case of variable merchant-based cash flows, where changes to key business drivers are critical to understand potential investment value changes under different economic and market conditions. Sensitivity analysis is also important in renewable power infrastructure projects where short-term and long-term variations in wind speed, cloud cover, rainfall, and other factors can undermine project finances.

CASE STUDY

Tay Bac Airport Sensitivity Analysis

Meg Zhu at InfraEast takes an additional step in her analysis by stress testing the two key drivers of value in her earlier analysis—namely, the expected growth rates for both the number of passengers and revenue per passenger. She creates a two-variable Excel data table to examine how the starting values for these two growth rates affect the valuation and IRR of the project:

Passenger Growth Rate (%)	Revenue per Passenger Growth (%) Base-Case Value: USD460,642,367		
	0%	1%	2%
7%	520,983,041	594,196,594	674,084,447
6%	457,813,060	524,660,869	597,531,959
5%	399,597,144	460,642,367	527,121,640
4%	345,930,584	401,687,248	462,344,864
3%	296,441,420	347,378,578	402,734,563

Passenger Growth Rate (%)	Revenue per Passenger Growth (%) Base-Case IRR: 13.51%		
	0%	1%	2%
7%	18.26%	23.56%	28.86%
6%	13.27%	18.54%	23.79%
5%	8.25%	13.51%	18.72%
4%	3.17%	8.44%	13.65%
3%	–2.00%	3.32%	8.53%

1. Discuss how changes in the growth expectations in her sensitivity analysis might cause Zhu to revisit her assumptions affecting the *numerator* of the infrastructure valuation.

   Solution:

   In her expected dividend calculations that make up the numerator of the infrastructure valuation as shown in Equation 5, Zhu has made the simple assumption that operating expenses are directly proportional to revenues. In the case of lower-than-expected passenger volumes, Zhu may consider revisiting this assumption due to the fixed costs of operating the airport at lower-than-expected capacity. However, if passenger volumes are much higher than her base case, the facility may face capacity constraints that require additional capital expenditures, which would lower expected dividends versus original estimates.

2. Discuss how changes in the growth expectations in her sensitivity analysis might cause Zhu to revisit her assumptions affecting the *denominator* of the infrastructure valuation.

   Solution:

   As noted in the answer to Question 1, changes in expected passenger volume may have an impact on both profitability and investment levels over the Tay Bac Airport project life cycle. Large deviations from the base case

assumptions may warrant an adjustment of the risk factors used to discount expected dividend cash flows. For example, lower-than-expected passenger growth might reduce the expected median profitability of the project and therefore imply a higher discount rate. However, higher-than-expected traffic may result in higher capital expenditure, increasing the investment risk factor and raising the discount rate.

3. Discuss how changes in inflation may affect the valuation of the Tay Bac Airport project.

Solution:

Inflation may be reflected by the growth in revenue per passenger shown at the top of the sensitivity tables. If an increase in inflation is accompanied by the ability of the Tay Bac Airport project to generate greater revenue growth per passenger, then subsequent improvements in cash flow from operations may assist in hedging Tay Bac Airport's value from the effects of inflation. While the sensitivity table shows value (and IRR) improvements as revenue growth per passenger increases, care must be taken to also assess inflationary effects on Tay Bac Airport's operating costs. Cost increases due to inflation may offset revenue increases. Furthermore, inflationary pressures may also negatively affect the demand for air travel, thus reducing the passenger growth rate. Overall, the effects of possible inflation on Tay Bac Airport's value are likely too complex to be reflected in the two-variable Excel table.

As the case study demonstrates, scenario and sensitivity analysis tools help investors and risk managers gauge the impact of changes in key value drivers but may also raise shortcomings of simplified model assumptions that warrant further refinement. In the following section, we will further address the drivers of relative risk and return among infrastructure investments and compare them to other private markets.

QUESTION SET

Meg Zhu at InfraEast continues her assessment of the sensitivity issues associated with the Tay Bac Airport project. Specifically, she wants to explore issues of cost overruns and delays in construction as they relate to valuation and debt service coverage, and she wants to review the discount rate assumptions.

Use relevant information from the Tay Bac Airport examples presented earlier to answer Questions 1–4.

1. Demonstrate the effect of a 10% cost overrun on the expected return to the equity investor of the Tay Bac Airport project, assuming that the cost overrun must be funded by an additional equity contribution in Year 3.

Solution:

A 10% cost overrun increases the amount of the overall project cost from USD900 million to USD990 million. We may use the Excel RATE function to calculate the revised project return. If the Year 3 project value remains at USD460,642,367, then the additional equity contribution of USD90,000,000 reduces the future value in Year 3 to USD370,642,367 (= 460,642,367 – 90,000,000) and we can calculate return as 5.57%.

Equity project return = RATE(nper, pmt, pv, fv)

= 5.57% = RATE(3, 0, -315000000, 437514322).

The IRR declines from 13.51% in the original scenario to 5.57% with the cost overrun.

2. Demonstrate the effect of a one-year delay on the expected return to the equity investor of the Tay Bac Airport project, assuming that all expected project cash flows remain in place (and assume for simplicity that debt can be renegotiated to delay debt cash flows for one year and that discount rates do not adjust for the delay).

   Solution:

   In this case, the value of the project (USD527,514,322) is delayed from the end of three years to the end of four years. Reverting the initial equity investment amount to USD315 million and changing the *nper* amount from three to four in the IRR formula result in

   Expected return = IRR(4, 0, -315000000, 460642367) = 9.97%.

   The IRR declines from 13.51% in the original scenario to 9.97% with the one-year delay.

3. Evaluate the one-year delay scenario if debt cash flows are not delayed by considering debt service coverage ratios of the Tay Bac Airport project.

   Solution:

   Given the growing cash inflows expected for the project throughout its life, the DSCRs are best considered at the times during the project when debt service reaches high points. In the earlier example in which debt service was examined, debt service reaches highs in Year 7 (USD101,840,048) and in Year 13 (USD125,465,048). So, a one-year delay in net cash flow from operations implies that the revised DSCR in Year 7 would be equal to the original Year 6 net cash flow from operations divided by 101,840,048. Similarly, for the DSCR in Year 13, the original Year 12 net cash flow from operations would be divided by 125,465,048.

   Revised Year 7 DSCR = 112,466,025/101,840,048 = 1.10.

   Revised Year 13 DSCR = 159,987,253/125,465,048 = 1.28.

   The one-year delay, while reducing the DSCRs for the Tay Bac Airport project, still allows for debt service to be fully covered from net cash flow from operations under the revised cash flow scenario.

4. Justify the pattern of declining discount factors used to determine the Tay Bac Airport project value.

   Solution:

   As shown earlier in the example, the discount rates decline over the life of the Tay Bac Airport project from 11.596% in the first year in which the asset generates positive cash flows to 10.5657% during the last year of the project. While several factors are used to determine the discount rate, including the size of the project, profitability, investment, and country and currency risk premiums, none of these factors vary over the project's life. Only the risk-free rate and the leverage factor show declines over the project's life. While the risk-free rate reflects an upward-sloping term structure, the increase is more than offset by the decline in the leverage factor premium. This reflects

the decline in the project's debt outstanding that begins after Year 6 and continues throughout the life span of the project.

6 INFRASTRUCTURE RISK AND RETURN

☐ discuss the risk and return among infrastructure investments and as compared to other investments as part of a strategic asset allocation

Investment features contributing to the unique role of infrastructure among private market assets stem from the provision of services with relatively inelastic demand and less exposure to market cyclicality or economic shocks. While most infrastructure investments involve a high distribution of stable cash flows over long-term contractual periods, they may also benefit from significant barriers to entry, as highlighted in the following example.

MACQUARIE SUPER CORE INFRASTRUCTURE FUND

As the world's largest infrastructure general partner, Sydney-based Macquarie Asset Management closed the first series of its Super Core Infrastructure Fund in 2018 with EUR2.5 billion in initial investments. The fund's focus is on core regulated infrastructure assets in gas and electricity distribution in Western Europe. At the time of its launch, initial projections of the fund's target return were 7%–8% with a 5% cash yield. Given the focus on core assets, the risk profile is lower than diversified infrastructure funds (with target returns of 10%–12%).

In late 2022, Macquarie closed a follow-on offering of EUR2.3 billion. Since the fund's inception, it also raised additional capital of EUR7.8 billion in co-investment, increasing total capital raised from investors in the super core strategy to EUR12.6 billion. The fund has expanded its geographic footprint and now owns assets in countries including the United Kingdom, Germany, Finland, Spain, and Greece.

The Super Core Infrastructure Fund has been classified as an Article 8 fund under the Sustainable Finance Disclosure Regulation as part of the EU's Financing Sustainable Growth Action Plan. Article 8 funds are those that promote environmental or social features. This classification is attractive to European institutional investors and global investors seeking investments in private market assets with ESG characteristics.

The Super Core Infrastructure Fund's acquisition focus involves the ownership of assets that connect electricity and gas production facilities, thus improving the capacity to distribute power from existing generation facilities. For example, the Super Core Infrastructure Fund owns the operator of the national electricity distribution network in Greece. By improving the ability of the network to distribute the electricity produced by solar and wind on the Greek mainland to the Greek islands, Macquarie's Super Core Infrastructure Fund expands the electrical grid, lowers household energy costs, and improves network reliability.

While assets in core infrastructure equity, such as the fund in the previous example, offer the lowest risk and return among infrastructure equity assets, their stable cash flows and favorable duration characteristics are increasingly seen as a long-term liability-matching alternative to default-risk-free government bonds.

These infrastructure investments typically offer return levels well in excess of other long-duration investments, provided an investor is able to accept these assets' lack of liquidity.

For example, the infra300 equity index of unlisted infrastructure investments had a return over a 10-year period (from 2009 to 2019) of just over 12% per annum, with a 13.9% total return volatility and just a 24% correlation with the MSCI World Index.

This liability-matching feature is increasingly used by long-term institutional investors, such as pensions, sovereign wealth funds, ultra-high-net-worth individuals, and family offices. These investors align their allocation to such investments with their risk tolerance, return objectives, and market expectations as demonstrated in the following example.

CASE STUDY

Northern States Infrastructure Investment Strategy

Northern States Pension Plan is a large US-based public pension plan that added infrastructure investments as a suballocation in its overall asset allocation to private markets in the past five years. Northern States has established the following investment policy for infrastructure assets:

Infrastructure investment strategic objectives:

- Improve investment portfolio diversification.
- Earn yield above earnings assumptions and generate stable cash flows.
- Match future liabilities and expected long-term distributions.
- Preserve capital and hedge against inflation.
- Engage as a responsible investor to promote sound environmental practices.

Infrastructure investment performance target:

The plan has a performance target of exceeding a return of US CPI plus 5.00% per annum net of fees on its private unlisted investments and seeks to exceed the appropriate public market benchmark for publicly traded infrastructure assets.

Long-term target infrastructure allocation ranges:

- Core: 30%–70%
- Value-add: 20%–60%
- Opportunistic: 5%–25%
- Publicly traded: 0%–10%
- Co-investment and direct investment: 0%–10%

Long-term target infrastructure geographic allocation:

- United States: 25%–70%
- OECD, Ex-US: 20%–60%
- Non-OECD: 0%–25%

In addition to limited liability companies and limited partnerships, Northern States policy allows for co-investment or direct investment in infrastructure assets without an asset manager. Northern States currently has a 70% allocation to US-based core infrastructure via a single closed-end fund and 30% to a value-add closed-end infrastructure fund focused on assets in the EU, all of which are member countries of the OECD.

Brianna Jenkins, head of alternative investments at Northern States, has asked you as an analyst on her team to prepare a memo related to the Tay Bac Airport equity investment opportunity for the investment committee.

1. Evaluate a possible equity investment by Northern States into the Tay Bac Airport opportunity with respect to the pension fund's performance target and allocation ranges for infrastructure investments.

   Solution:

   First, Northern States has a performance target of exceeding a return of US CPI plus 5.00% per annum net of fees on its private unlisted investments. In an earlier section, the internal rate of return for the Tay Bac Airport project was calculated as 13.51%. As such, the Tay Bac Airport investment opportunity is likely to achieve the pension fund's performance target assuming inflation remains relatively unchanged.

   Second, Northern States has a current 70% core infrastructure and 30% value-add infrastructure allocation. However, the pension fund is allowed to allocate between 5% and 25% to opportunistic infrastructure assets, and this is likely the classification to which the Tay Bac Airport project belongs.

   Given that Northern States currently has no allocation to opportunistic infrastructure, an investment in the Tay Bac Airport project appears plausible in this component of the fund's target allocations.

   Finally, Northern States has the potential to further diversify its portfolio internationally. Its current allocations are 70% to the United States (which is at the maximum of its target) and 30% to the EU (which is in the middle of its target). Northern States may allocate up to 25% to infrastructure assets in non-OECD countries.

   Overall, an investment in the Tay Bac Airport project is feasible when considering Northern States' performance target and allocation ranges for infrastructure asset investment.

2. Evaluate a possible equity investment by Northern States into the Tay Bac Airport opportunity with respect to the pension fund's strategic objectives for infrastructure investments.

   Solution:

   Northern States has the following strategic objectives for its infrastructure investments:

   - Improve investment portfolio diversification.
   - Target return at or above earnings assumptions and generate stable cash flows.
   - Match future liabilities and expected long-term distributions.
   - Preserve capital and hedge against inflation.
   - Engage as a responsible investor to promote sound environmental practices.

   An investment in Tay Bac Airport would provide both asset-type and geographic diversification, as discussed in the prior solution, and its expected return of 13.51% appears likely to meet the performance target of 5% above US CPI.

   However, the cash flow projections presented in an earlier section suggest that the Tay Bac Airport project may not generate stable cash flows, making long-term liability matching potentially difficult.

Future spikes in inflation may dampen leisure travel, thus reducing the project's cash flows. As such, this investment may be a less effective inflation hedge.

Finally, given Northern States' stated goal of promoting sound environmental practices, the analyst may need to weigh any potential environmental benefits of the airport project as a more efficient means of travel than, for example, road construction in promoting economic growth and tourism versus the expected increase in air travel often cited as a contributor to greenhouse gas emissions.

Despite their complexity and illiquidity, unlisted infrastructure investments can add diversified, stable cash flows to effectively match an investor's anticipated liability cash flows in the context of an investment strategy and policy. The examples in this learning module used to evaluate the structure, method, investment process over the life cycle, and estimated market value of these assets are similar to those used by practitioners to thoroughly evaluate the expected risk and return of these investments.

QUESTION SET

1. Using the case study and example from Infrastructure Risk and Return, evaluate whether Northern States Pension Fund would likely benefit from an investment in the Macquarie Super Core Infrastructure Fund relative to its current infrastructure allocation.

   Solution:

   Northern States would be unlikely to benefit from investing in the Super Core Infrastructure Fund.

   It has reached its current maximum allocation to core infrastructure asset investments, so any amount invested in the Super Core Infrastructure Fund would require a liquidation of its current US closed-end fund holding in core infrastructure. Although this change would improve the geographic diversification of its infrastructure portfolio, the return performance may be more related to the core feature.

2. Evaluate whether Northern States would favor an infrastructure asset investment with availability-based payments with respect to its strategic objectives.

   Solution:

   An infrastructure asset with availability-based payment provides a fixed income stream, so this would best allow for Northern States' goal of achieving a match between its liabilities and the cash flows from investment.

3. Which of the following strategic objectives listed in the Northern States example is least likely to be provided by an investment in Vento Anglio Limited, introduced in an earlier example for an investor heavily invested in core infrastructure?

   A. Improve portfolio diversification.

   B. Match future liabilities and expected long-term distributions.

C. Engage as a responsible investor by promoting sound environmental practices.

Solution:

A is the correct response. Because the VAL project produces electricity and is paid a fixed price through a contract for difference arrangement, its income stream is likely similar to core infrastructure in electricity generation.

B is incorrect because of the fixed price arrangement. C is incorrect because the wind farm project promotes sound environmental practices.

PRACTICE PROBLEMS

The following information relates to questions 1-5

Brianna Jenkins, head of alternative investments at Northern States Pension Plan, a large US-based public pension plan, is helping a new analyst become familiar with private infrastructure investment.

After covering basics of classifying infrastructure investments across the risk–return spectrum, Jenkins mentions that Northern States has a 70% allocation to US-based core infrastructure via a single closed-end fund and 30% to a value-add closed-end infrastructure fund focused on assets in the EU.

The analyst asks Jenkins about the revenue streams associated with private infrastructure assets, and Jenkins outlined the basics of the three types of payment streams that asset operators receive: availability based, commercial (also called merchant), and regulation based. Jenkins noted how these payment structures create differing levels of business risk for investors in these assets. Jenkins further discussed how private infrastructure assets fit within a broader diversified portfolio.

The analyst asked Jenkins about Northern States' history of private infrastructure investing, and Jenkins explained how Northern States had grown its expertise in infrastructure over the last five years and is now able to participate in the market as a direct investor in specific infrastructure industries. Additionally, Northern States continued to build related industry-specific expertise through its equity investments.

1. Which of the following allocation changes should Northern States consider in order to assume greater risk in its infrastructure suballocation?

   A. Add an allocation to core-plus assets while decreasing its value-add assets.

   B. Add an allocation to opportunistic assets while decreasing its core assets.

   C. Increase its allocation to core assets while decreasing its value-add assets.

2. Which of the following payment approaches is likely associated with the most business risk for a private infrastructure investment?

   A. Availability-based payment

   B. Commercial payment

   C. Regulation-based payment

3. Discuss the factors that are likely to make private infrastructure assets an effective portfolio diversifier.

4. Discuss how industry expertise factors into the methods by which Northern States may participate as an equity co-investor or direct investor in private infrastructure projects.

5. Contrast the cash flow assumptions of valuing a private infrastructure asset under the build–operate–transfer model relative to a private real estate investment.

The following information relates to questions 6-9

The 125 MW Vento Anglio Limited project involves the purchase and installation of 50 2.5 MW wind turbines at a cost of GBP1.1 million per MW, with total development costs incurred either upfront or equally over three years, as shown in the following table.

VAL Development Costs	GBP
Wind Turbines & Related Costs	137,500,000
Contingency Reserve	6,500,000
Operating Deficit Reserves	4,255,000
Interest Reserves	4,020,000
Development Fees	2,300,000
Misc. Closing Costs	2,000,000
Land Use Cost	1,825,000
Site Setup Costs	1,600,000
Total	160,000,000

VAL turbines have a 30-year serviceable life, and VAL has contracted with LCCC for fixed-price delivery under a 15-year CfD agreement at a rate of GBP0.075 per kWh when operations begin. While the vast majority of the total development costs consist of the outlay for the wind turbines, close to GBP15 million of the cost budget is set up as contingency and reserve funds.

VAL Project Financing Plan

Equity: GBP50,000,000

Debt: GBP110,000,000 from private investors in two forms:

C&D loan

- 8% annual interest
- Monthly disbursements linked to construction milestones, such as site setup and timely commissioning of wind turbines as scheduled
- Interest accrues monthly over a three-year construction period.
- The loan is to be repaid from amortizing term loan proceeds.
- Secured by VAL land, equipment, and other project assets
- 36 end-of-month drawdowns of GBP2,725,108 each

Amortizing term loan

- 15-year, GBP110,000,000 amortizing loan starting in three years
- Drawn once 125 MW are fully operational and connected to grid
- 7% annual interest rate with 180 fixed monthly payments of interest and principal repayment
- Secured by VAL land, equipment, and other project assets

VAL's expected revenue from its first full year of operation is shown in the following table.

VAL Operations	
Actual Output (kWh)	364,087,500
Fixed Price for Delivery (GBP/kWh)	GBP0.075
First Full Year of Revenue	GBP27,306,563
Operating Expenses (45% of revenue)	(GBP12,287,953)
CapEx	(GBP4,125,000)
Net Cash Flow from Operations	**GBP10,893,609**

With a contractual rate of GBP0.075 per kWh, first-year estimated revenue is GBP27,306,563 (= 364,087,500 × GBP0.075).

6. Discuss why an SPE such as VAL would establish reserve accounts.

7. Which of the following cash flow structures best characterizes VAL's business risk in the TICCS system?

   A. Availability-based payments

   B. Commercial payments

   C. Regulation-based payments

8. Discuss VAL's rationale for financing the wind farm with two different forms of debt.

9. Demonstrate that VAL's contract for difference with LCCC guarantees the same annual revenue regardless of the prevailing market price of electricity assuming no fluctuation in wind speeds.

The following information relates to questions 10-13

Meg Zhu is a senior analyst at InfraEast, an infrastructure firm considering an equity investment in the VAL wind farm project, and she has built a spreadsheet model based on facts shown in the previous Item Set.

Zhu is working on assessing the sensitivity of project value. The first issue with which she is concerned is the CfD rate. Rather than a rate of GBP0.0.075 per kWh, she has decided to lower the assumption of the CfD rate to GBP0.07 per kWh to reflect any potential decline in prices before the CfD terms are set. Zhu estimates the value of the project's equity given a CfD rate of 0.075 per kWh at GBP74,376,852, and her value estimate declines to GBP58,706,468 if she assumes a CfD rate of 0.07 per kWh. Zhu believes that 8% is an acceptable hurdle rate for a wind farm project in a developed market. Ultimately, she decides to base her valuation on a CfD rate of 0.075 per kWh.

Zhu is concerned about the effects on future electricity prices of continued expansion of solar and wind power capacity, so she decides to build in an assumption that after the CfD contract price for the first 15 years expires, VAL will have to contract for a lower market price for electricity for the latter half (Years 16–30) of the wind farm's life. She is uncertain as to whether and how the CfD

scheme will change in the future. She believes that a GBP0.07 market electricity rate might be a real possibility at the end of 15 years. The following table shows selected data from the projections in Year 15 of the wind farm's operation (based on a rate of GBP0.075 per kWh). Revenue and operating expenses grow over time at a 1.5% annual rate.

Revenue (GBP)	Operating Expense + CapEx	Net Cash Flow from Operations	Debt Service
33,635,015	19,260,757	14,374,258	11,864,533

Zhu has also been carefully considering how to estimate discount rates for the valuation. She has decided to estimate zero-coupon GBP bond rates and then adjust each year's discount rate to reflect project size, leverage, profitability, and investment. She maintains a size premium of 1.0% and an investment premium of 0.5% for all 30 years of the project. During the first 15 years of the project, she includes a 3.0% leverage premium and a –1.0% premium (i.e., 1.0% discount) for profitability. During the final 15 years of the project, the leverage premium is set to 0.0%.

10. Recommend whether Zhu should view an investment in the VAL project's equity as acceptable given her two possible CfD scenarios and justify your recommendation.

11. Calculate the effect of the lower market electricity rate of GBP0.07 per kWh on VAL's expected revenue for the wind farm in Year 16. Assume a constant annual growth in demand factor of 1.5%.

12. Discuss whether the change in Zhu's assumptions about market electricity rates will affect the projected VAL equity dividend rate between Years 15 and 16 of the wind farm's operation. For simplicity, assume expenses grow in line with demand.

13. Discuss why Zhu decides to change the leverage premium in the discount rate for the final 15 years (Years 16–30) of the VAL project.

SOLUTIONS

1. The correct response is B. Opportunistic assets are the highest risk classification among the infrastructure categories. Changing its allocation to Opportunistic will increase its risk profile.

   Response A is incorrect because core-plus assets are typically lower risk than value-add assets. Response C is incorrect because core assets are lower risk than value-add assets.

2. The correct response is B. Commercial (or merchant) payments will vary based on demand for the infrastructure asset, such as in the case of collections on a toll road.

   Response A is incorrect because availability-based payments are fixed by the contract and thus create lower business risk. Response C is incorrect because regulation-based payments are fixed by government authorities to allow for a sufficient rate of return, such as in the case of power companies.

3. Private infrastructure assets are used to provide essential or public services with few substitutes and typically are characterized by inelastic demand. Infrastructure asset returns typically exhibit lower correlation with other asset classes and tend to be less exposed to cyclicality or market downturns.

4. Northern States participates as an equity investor as a limited partner in infrastructure assets in industries in which it has not yet built sufficient expertise to manage the investment process more directly. As it gains sufficient expertise in a specific industry, it is more likely to invest as a general partner or co-investor in infrastructure assets in that industry.

5. Both types of private asset categories require a cash flow forecast over a time horizon. The point of contrast is that a private real estate asset is expected to be sold at the end of the time horizon and cash is expected to be received. A private infrastructure asset is usually assumed to have zero value at the end of the cash flow forecasting time horizon because the asset is transferred from the concessionaire to the grantor at that point in time.

6. The SPE's debt may in some cases be enhanced by the establishment of reserve accounts for debt service and other obligations. For example, when project cash flows are less predictable, a debt service reserve account is often established that accumulates sufficient cash in order to meet specific debt service requirements and from which funds are released when payments are due. Reserve accounts are often used for operating and maintenance costs and decommissioning equipment at the end of the project's serviceable life, such as the eventual closure and dismantling of wind turbines in the case of VAL.

7. Response C is correct. Power companies are regulated by government entities, and the price that they are able to charge is based on these regulations. The CfD structure of VAL supplements the regulatory nature of the payment scheme by fixing a price per kWh for a specific volume, ignoring the impact of wind speed variability.

   Response A is incorrect because the payment can still fluctuate based on electricity demand. Response B is incorrect because commercial payments are more variable based on the demand for the infrastructure asset's usage.

8. The VAL wind farm is financed in two phases. The first phase provides the shorter-term financing required to build the asset, and this phase is expected

to last three years. Thus, the construction and development loan provides this financing, and repayment of the loan occurs from the second phase of financing: the amortizing 15-year term loan. Once construction is completed and the wind farm begins operation, the wind farm generates cash flows and VAL can make fixed repayments of principal and interest on this loan from the expected cash flows from electricity sales.

9. The CfD guarantees that VAL will generate revenue of GBP0.075 per kWh regardless of the price at which it sells electricity output. The intermittent market reference price is the market reference price, and for simplicity, we assume an annual IMRP; this is the price at which VAL will sell its electricity. If the IMRP is greater than GBP0.075 per kWh, then VAL will make a payment to LCCC for the difference. For example, suppose the IMRP is GBP0.09 per kWh on average for a full year. Then, VAL's revenue is GBP32,767,875 (= 364,087,500 × GBP0.09).

   However, VAL must make a payment to LCCC for the difference between the IMRP and the CfD rate. This payment is GBP5,461,313[= 364,087,500 × (GBP0.09 – GBP0.075)]. Subtracting the amount of this payment from VAL's revenue calculated previously provides VAL's guaranteed revenue of 27,306,563.

   If the IMRP is less than GBP0.075 per kWh, then VAL will receive a payment from LCCC for the difference. Suppose the IMRP is GBP0.06 per kWh on average for a full year. Then, VAL's revenue is GBP21,845,250 (= 364,087,500 × GBP0.06).

   However, VAL receives a payment from LCCC for the difference between the IMRP and the CfD rate. This payment is GBP5,461,313 [= 364,087,500 × (GBP0.075 – GBP0.06)]. Adding the amount of this payment to VAL's revenue calculated previously provides VAL's guaranteed revenue of 27,306,563.

10. The IRR of the VAL project's equity under the original assumption of GBP0.075 as the guaranteed rate for the full 30-year time horizon of the project is equal to 14.15% [= RATE(nper, pmt, -pv, fv) = RATE(3, 0, -50000000, 74376852)].

    The IRR of the VAL project under the updated assumption of GBP0.07 as the guaranteed rate for the full 30-year time horizon of the project is equal to 5.50% [= RATE(nper, pmt, -pv, fv) = RATE(3, 0, -50000000, 58706468)].

    The IRR of the VAL project exceeds the 8% hurdle rate at a CfD rate of 0.075 but fails to do so if the CfD rate is 0.07. As such, Zhu's assumption about future electricity rates is critical to her recommendation. If she fully believes that a CfD rate of 0.075 is attainable, then an investment in the VAL project is attractive.

11. Year 16 of the revised revenue forecast may be estimated by first calculating the percentage decline in revenue from Year 15 to Year 16 due to the price change. We first divide the new market rate of GBP0.07 per kWh by the prior rate of GBP0.075, then multiply the result by the constant annual growth factor of 1.015, and finally subtract from 1:

    $$5.27\% = \left(1 - \frac{\text{GBP0.07}}{\text{GBP0.075}} \times 1.015\right).$$

    We can calculate the revised Year 16 revenue by multiplying the expected Year 15 revenue by this result:

    Revised Year 16 revenue: GBP31,863,571 = (1 – 0.0527) × GBP33,635,015.

12. Recall from Equations 3 and 4 that the equity dividend rate is calculated as follows:

    $$\text{Equity dividend rate} = \frac{\text{Before-tax net cash flow}}{\text{Project cost} - \text{Debt outstanding}},$$

    where

Before-tax cash flow = Net cash flow from operations – Debt service.

The most notable aspect from these formulas is that debt service declines from its Year 15 amount of GBP11,864,533 to zero in Year 16. Thus, all else equal, the before-tax cash flow increases by over GBP11.8 million between Years 15 and 16 because VAL's debt service has been paid. As a result, we would expect a significant increase in the equity dividend rate in Year 16 compared to Year 15 despite the decline in revenue from a decline in the assumed electricity price.

We can also explicitly show this result by estimating the equity dividend rate in both years. First, solve for before-tax cash flow in Year 15 using the information from the table: GBP2,509,725 (= 14,374,258 – 11,864,533). This gives an equity dividend rate of 5.02% (= 2,509,725/50,000,000). Year 16 net cash flow from operations is estimated by subtracting estimated operating expenses and capital expenditures (which grow at a rate of 1.5% per year from the Year 15 amount of GBP19,260,757) from estimated Year 16 revenue:

Net cash flow from operations = Revenue – Operating expenses.

GBP12,313,903 = 31,863,571 – (19,260,757 × 1.015).

This result is equal to the before-tax cash flow in the numerator of Equation 3, while the denominator equals the equity contribution of GBP50 million. Solve for the equity dividend rate as 13.25%:

$$24.63\% = \frac{\text{GBP12,313,903}}{\text{GBP50,000,000}}.$$

13. The 15-year term loan is fully repaid following the first 15 years of the VAL wind farm project. During the first 15 years of the project, the discount rate warranted a premium to reflect the risk associated with the project's financial leverage. Once the debt is repaid, the discount rate can be reduced to reflect the lack of required debt service payments in the project's capital structure from Years 16 to 30.

Glossary