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CAIA®

EXAM PREP

SchweserNotes™

Real Assets and Private Equity

Level I Book 2

KAPLAN SCHWESER

Book 2: Real Assets and Private Equity

SchweserNotes™ 2027

CAIA Level I



SCHWESERNOTES™ 2027 CAIA® LEVEL I BOOK 2: REAL ASSETS AND PRIVATE EQUITY

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Readings and Learning Objectives

TOPIC 3

CAIA Association. *CAIA Curriculum Level I Volume II*. Self-published, CAIA Association, 2026.

Reading 3.1: Natural Resources and Land

3.1.1: Demonstrate knowledge of natural resources other than land.
Including:

- Discuss natural resources as an exchange option.
- Discuss the concept of moneyness as it pertains to the development of natural resources.
- Discuss why some in-the-money development options should not be immediately exercised.
- Describe the relationship between the moneyness of natural resource options and short-term financial risks.

3.1.2: Demonstrate knowledge of land as an alternative asset.
Including:

- Describe the three types of land lots (i.e., paper lots, blue top lots, and finished lots).
- Discuss investment in undeveloped land as a call option.
- Apply the binomial option pricing technique for valuing land as a call option.
- Describe the risks and returns of investing in land.
- Calculate the expected return of land investments.

3.1.3: Demonstrate knowledge of timber and timberland as alternative assets.
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- Discuss the characteristics of timber and timberland.
- Discuss the role of timberland investment management organizations (TIMOs).
- Describe the risks and returns of timberland investments.
- Identify methods of gaining exposure to timberland.
- Explain benefits and disadvantages of timber investment.

3.1.4: Demonstrate knowledge of farmland as an alternative asset.
Including:

- Discuss the characteristics of farmland investments.
- Calculate the value of farmland based on annual operating income and the cap rate.
- Understand the structure of farmland ownership and management.
- Discuss supply and demand factors of agricultural products.
- Identify three key benefits and three key disadvantages of farmland investment.
- Identify methods of obtaining exposure to farmland.
- Discuss the value and importance of assets with multiple purposes.

3.1.5: Demonstrate knowledge of contagion, price indices, and biases in real estate values.
Including:

- Discuss the reliability of market prices versus appraisal-based data.

- Define contagion.

3.1.6: Demonstrate knowledge of observations regarding historical returns of timberland and farmland.
Including:

- Summarize the key observations on historical timber and farmland returns that are consistent with economic reasoning.

Reading 3.2: Commodities

3.2.1: Demonstrate knowledge of investing in commodities without futures.
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- Discuss disadvantages of direct investment in physical commodities.
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- Describe investments in commodities through exchange-traded funds (ETFs).
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- Apply option valuation methods to price commodity-linked notes.

3.2.2: Demonstrate knowledge of commodity producers.
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- Describe the empirical evidence between commodity prices and operating firms.
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3.2.3: Demonstrate knowledge of liquid alternative real assets.
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3.2.6: Demonstrate knowledge of normal backwardation and normal contango.
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- Discuss commodities as diversifiers in a perfect market equilibrium.
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- Interpret theoretical evidence on expected commodity returns.
- Discuss irrelevancy of commodity price expectations to returns on futures contracts.
- Identify four favorable characteristics of commodities with respect to event risks.
- Describe commodities as a defensive investment.
- Discuss institutional investing demand and its effect on commodity prices.

3.2.9: Demonstrate knowledge of commodity indices.
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- Discuss the process of construction of commodity futures indices.
- Discuss the characteristics of commodity indices given by S&P GSCI, BCOM, and CRB.
- Discuss production-weighted long only commodity indices.
- Discuss market liquidity-weighted long only commodity indices.
- Discuss tier-weighted long only commodity indices.

3.2.10: Demonstrate knowledge of observations regarding historical returns of commodities.
Including:

- Summarize the key observations on historical commodity returns that are consistent with economic reasoning.

Reading 3.3: Infrastructure

3.3.1: Demonstrate knowledge of the history of infrastructure investment.
Including:

- Understand the history of infrastructure investing.
- Discuss the evolution of investing in infrastructure.
- Contrast the role of government and the private sector in infrastructure investing.

3.3.2: Demonstrate knowledge of infrastructure characteristics.
Including:

- Identify the six primary characteristics of infrastructure.
- Understand how the characteristics collectively define investable infrastructure.

3.3.3: Demonstrate knowledge of risks of infrastructure investing.
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- Understand the five key risks associated with infrastructure investing.
- Explain strategies investors can implement to mitigate the five key risks.

3.3.4: Demonstrate knowledge of infrastructure sectors and assets.
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- Summarize the five primary sectors of infrastructure.
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- Distinguish between greenfield and brownfield assets.

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- Describe the four styles of infrastructure investment.
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3.3.6: Demonstrate knowledge of project finance in the context of infrastructure investing.
Including:
- Explain the historical significance of the use of project finance in infrastructure investing.
- Identify the main characteristics of project finance structures.

3.3.7: Demonstrate knowledge of typical capital structures for infrastructure assets.
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3.3.8: Demonstrate knowledge of the historical profile of infrastructure risks and returns.
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3.3.9: Demonstrate knowledge of inflation and economic sensitivity of infrastructure.
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- Analyze the impact of adding an allocation to infrastructure to an investment portfolio.

3.3.10: Demonstrate knowledge of developed market versus emerging market infrastructure.
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- Contrast infrastructure investing in developed markets with emerging markets.
- Apply risk management practices to geographic risks in infrastructure investing.

3.3.11: Demonstrate knowledge of due diligence best practices for infrastructure investing.
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- Apply due diligence practices to infrastructure fund investing.
- Apply due diligence practices to direct infrastructure investing.

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3.4.1: Demonstrate knowledge of categories of real estate.
Including:
- Contrast the private and public ownership of real estate.
- Discuss the investment continuum of real estate equity and debt investing.
- Understand how allocators access residential real estate investments.
- Detail the major property types and subcategories of commercial real estate.

- Discuss real estate categorization based on market size.
- Understand the challenges of international real estate investments.

3.4.2: Demonstrate knowledge of advantages, disadvantages, and styles of commercial real estate investments.

Including:

- Discuss seven potential advantages of investing in commercial real estate.
- Discuss four potential disadvantages of investing in commercial real estate.
- Describe styles of real estate investing.
- Understand the core real estate style of investment.
- Understand the value-add real estate style of investment.
- Understand the opportunistic real estate style of investment.
- Describe the attributes of differentiating real estate styles.
- Discuss the purposes of real estate style analysis.

3.4.3: Demonstrate knowledge of the three real estate investment styles.

Including:

- Construct a portfolio that would meet real estate policy objectives by utilizing the three investment styles to add portfolio tilts.

3.4.4: Demonstrate knowledge of the office real estate sector.

Including:

- Identify the various types of office properties.
- Understand the classification of office properties.
- Discuss the factors impacting cap rates of office properties.
- Understand the supply and demand dynamics related to office properties.

3.4.5: Demonstrate knowledge of the industrial and retail real estate sectors.

Including:

- Identify the various types of industrial properties.
- Identify the various types of retail properties.
- Discuss the factors impacting cap rates of industrial properties.
- Discuss the factors impacting cap rates of retail properties.
- Understand the supply and demand dynamics related to industrial properties.
- Understand the supply and demand dynamics related to retail properties.

3.4.6: Demonstrate knowledge of the multifamily and other real estate sectors.

Including:

- Identify the various types of multifamily properties.
- Identify the various types of other real estate properties.
- Understand the supply and demand dynamics related to multifamily properties.

Reading 3.5: Real Estate Assets

3.5.1: Demonstrate knowledge of the debt securities in the private market real estate capital stack.

Including:

- Compare the characteristics of first mortgages, A/B structures, second mortgages, and mezzanine debt.
- Describe a fulcrum security.

3.5.2: Demonstrate knowledge of the equity portion of the private market real estate capital stack.

Including:

- Compare the characteristics of preferred equity and common equity.
- Describe the purpose of the intercreditor agreement.

- Compare the capital stack of a mortgaged fee simple deal to a leveraged asset on a ground lease.
- Calculate the total leverage and equity needed for a project on a ground lease.

3.5.3: Demonstrate knowledge of commercial mortgages in the context of alternative investments.
Including:

- Describe the analysis of default risk of commercial mortgages.
- Identify and apply financial ratios employed in the analysis of commercial mortgage default.
- Estimate the effects of leverage on cash-on-cash returns.

3.5.4: Demonstrate knowledge of commercial mortgages in the context of alternative investments.
Including:

- Describe characteristics of the different types of commercial real estate mortgages: construction mortgages, mini-perm construction mortgages, transitional mortgages, and permanent mortgages.
- Describe characteristics of commercial real estate first mortgages, first mortgage A/B note structures, second mortgages, and stretched first mortgages.
- Understand the advantages and disadvantages to both borrower and lender of each type of mortgage.

3.5.5: Demonstrate knowledge of the investment continuum in private market real estate.
Including:

- Contrast the characteristics of mezzanine debt, preferred equity, common equity, and ground leases as alternatives for financing real estate projects.
- Describe a fulcrum security.

3.5.6: Demonstrate knowledge of alternative real estate investment vehicles.
Including:

- Identify and describe private market real estate investment structures and the subcategories of each structure.
- Identify and describe the advantages and disadvantages of each investment structure’s subcategories.
- Identify and describe private equity real estate funds.
- Identify and describe commingled real estate funds.
- Identify and describe syndications.
- Identify and describe joint ventures.
- Describe limited partnerships, and apply the concepts of gearing and loan-to-value (LTV) ratios.

3.5.7: Demonstrate knowledge of liquid alternatives including REITs and REOCs.
Including:

- Define types of real estate investment trusts (REITs).
- List advantages and disadvantages of REITs as an investment.
- Contrast private and public REITs.
- Define the FTSE NAREIT US Real Estate Index Series.
- Contrast the structures of REITs and real estate operating companies (REOCs).

Reading 3.6: Real Estate Methods

3.6.1: Demonstrate knowledge of real estate development in the context of alternative investments.
Including:

- Calculate a development yield.
- Understand the importance of due diligence in formulating assumptions.
- Describe the difference between hard and soft costs.

- Understand the relationship between the development yield and the market cap rate and how it can affect the development decision.

3.6.2: Demonstrate knowledge of commercial real estate valuation.
Including:

- Discuss the importance of commercial real estate equity exposures.
- Identify the four appraisal assumptions.
- Identify the six items that are included in an appraisal report.
- Identify and discuss the three common methodologies used in commercial real estate valuations.
- Explain the sales comparison approach and when it is most useful.
- Explain the cost approach and when it is most useful.
- Explain the income approach and the three subcategories of cap rate, discounted cash flow, and gross income multiplier.
- Calculate cap rates.
- Calculate a gross income multiplier.
- Explain the two ways to calculate a reversion cap rate for a discount cash flow valuation.
- Describe the NCREIF property index as an appraisal-based index.

3.6.3: Demonstrate knowledge of valuation and risks of real estate equity as well as the income method of real estate valuation.
Including:

- Apply the discounted cash flow approach (i.e., income approach) to the calculation of net operating income.
- Calculate a real estate project's discount rate using the risk premium approach, and use that rate to value the project.
- Understand the role of taxes in estimating both the discount rate and the cash flows of a real estate project.
- Calculate the appraised value of an office building using the income approach.

3.6.4: Demonstrate knowledge of alternative real estate investment vehicles and equity REIT returns.
Including:

- Identify and describe open-end real estate mutual funds.
- Discuss options and futures on real estate indices.
- Identify and describe exchange-traded funds based on real estate indices.
- Identify and describe closed-end real estate mutual funds.
- Discuss equity real estate investment trusts.
- Contrast private and public REITs.
- Discuss possible illiquidity premiums in public REITs.
- Define the FTSE NAREIT US Real Estate Index Series.

3.6.5: Demonstrate knowledge of historical risks and returns of equity real estate investment trusts (REITs).
Including:

- Summarize the key observations on historical equity REIT returns that are consistent with economic reasoning.

CAIA Association. *CAIA Curriculum Level I Volume II*. Self-published, CAIA Association, 2026.

Reading 4.1: Private Equity Investing

4.1.1: Demonstrate knowledge of the three main private equity strategies.
Including:
- Discuss private equity as an asset class and the three primary private equity strategies.
- Understand the relationship between the business life cycle and stages of private equity investing.
- Distinguish between venture capital, growth equity, and buyouts.

4.1.2: Demonstrate knowledge of private equity (PE) firms and funds.
Including:
- Define PE funds.
- Discuss the organization structure of PE funds.
- Understand PE investment by institutional investors.
- Discuss PE fund intermediation around efficient inefficiencies.
- Identify the five primary functions of PE funds.

4.1.3: Demonstrate knowledge of institutional investor PE fund programs.
Including:
- Describe forms of PE fund intermediation.
- Discuss the life cycle and stages of development of fund investment programs.
- Interpret the fund J-curve.
- Understand undrawn capital commitments.

4.1.4: Demonstrate knowledge of subscription lines in private equity.
Including:
- Identify the benefits and risks to general partners and limited partners when subscription lines are used.
- Apply IRR methodology to determine the change in reported return when subscription lines are used.

4.1.5: Demonstrate knowledge of the limited partner (LP) and general partner (GP) relationship life cycle in private equity.
Including:
- Understand the relationship between LPs and GPs in PE.
- Discuss the three phases in LP and GP relationships.

4.1.6: Demonstrate knowledge of publicly traded PE firms.
Including:
- Understand governance issues within publicly traded PE firms.
- Contrast PE governance structures.

4.1.7: Demonstrate knowledge of exit strategies for private equity and venture capital portfolio company investments.
Including:
- Identify the various types of exits available to private equity managers.
- Compare strategic mergers to financial mergers or secondary buyouts.
- Understand the IPO process.
- Discuss direct listings.

4.1.8: Demonstrate knowledge of SPACs.
Including:

- Understand SPACs.
- Compare direct listings, special purpose acquisition corporations (SPACs), and initial public offerings (IPOs), including their advantages and disadvantages.
- Explain how and when the shares of a SPAC can be described as a default-free convertible bond.

Reading 4.2: Venture Capital & Growth Equity

4.2.1: Demonstrate knowledge of venture capital and its role financing startups.
Including:

- Define venture capital opportunities and venture capitalists.
- Discuss the history of venture capital.
- Understand the cash needs for startups and the VC financing model.

4.2.2: Demonstrate knowledge of the stages of venture capital.
Including:

- Distinguish between the earlier stages and later stages of venture capital investing.
- Contrast pre-seed, seed, and Series A stages.
- Identify investment and company characteristics by stage.

4.2.3: Demonstrate knowledge of venture capital risk and returns.
Including:

- Understand the historical returns of venture capital fund investors.
- Explain the risk profile of venture capital investments.
- Interpret the J-curve for private equity projects.
- Discuss return expectations for venture capital investors.

4.2.4: Demonstrate knowledge of academic research on venture returns.
Including:

- Understand performance persistence in venture capital returns.
- Identify return drivers of venture capital funds.
- Apply the conclusions from academic research on VC investing.
- Discuss the three primary risk premiums associated with venture capital investing.

4.2.5: Demonstrate knowledge of venture capital valuation methods.
Including:

- Apply the valuation of VC companies based on Total Addressable Market.
- Apply the valuation of VC companies based on operating income.
- Understand the economic rationale for the high discount rates used by venture capitalists.
- Distinguish between pre-money valuation and post-money valuation.

4.2.6: Demonstrate knowledge of venture capital follow-on financing decisions.
Including:

- Discuss the factors in the decision process for follow-on investments.
- Discuss venture capital business plans.
- Analyze equity dilution in follow-on financings.
- Recommend a fund reserve strategy.

4.2.7: Demonstrate knowledge of venture capital securities.
Including:

- Identify the types of securities used by venture capitalists.
- Contrast Simple Agreement for Future Equity (SAFE) with warrants.
- Explain the advantages of using convertible preferred stock.

4.2.8: Demonstrate knowledge of the dynamics of venture opportunities.
Including:

- Identify implications of winner-take-all markets.
- Identify implications of longer time horizons to exits.
- Identify three potential reasons for the declining number of public firms in the US.
- Discuss competition between private and public ownership structures.

4.2.9: Demonstrate knowledge of growth equity.
Including:

- Describe growth equity investing.
- Understand the history of growth equity.
- Identify common characteristics of growth equity investments.

4.2.10: Demonstrate knowledge of valuation and risks of growth equity investments.
Including:

- Summarize value creation levers for growth equity investments.
- Explain the valuation of growth equity based on revenue.
- Calculate the valuation of growth equity based on revenue.
- Identify risks unique to growth equity investments.

4.2.11: Demonstrate knowledge of growth equity deal characteristics.
Including:

- Discuss protective provisions as a key deal characteristic in growth equity investment.
- Discuss redemption rights as a key deal characteristic in growth equity investment.

Reading 4.3: Buyout

4.3.1: Demonstrate knowledge of buyouts and leveraged buyouts, and merchant banking.
Including:

- Explain the buyout strategy.
- Discuss the history of leveraged buyouts.
- Discuss three key economic and agency issues of buyouts.
- Describe the evolution of the buyout market.
- Understand buyout objectives.
- Discuss capital structure optimization in buyouts.
- Discuss operation efficiency in buyouts.
- Discuss merchant banking practices.

4.3.2: Demonstrate knowledge of the various buyout strategies.
Including:

- Identify the categories of LBOs.
- Contrast the different types of private equity buyouts.

4.3.3: Demonstrate knowledge of the characteristics of buyout funds.
Including:

- Contrast LBO funds by target cap size.
- Analyze total number, size, and implications of buyout fund fees.
- Discuss agency relationships and their role in LBO firms.
- Understand LBO auction markets.
- Understand benefits and concerns of club deals in LBOs.
- Discuss factors driving buyout risks relative to VC risks.

4.3.4: Demonstrate knowledge of leveraged buyouts (LBOs).
Including:

- Calculate projected valuations of an LBO.
- Identify LBO exit strategies.
- Identify benefits of strong corporate governance principles to the public market.

4.3.5: Demonstrate knowledge of private investments in public equity (PIPEs).
Including:

- Identify characteristics and types of securities issued through PIPEs.
- Understand motivations of buyers and sellers in PIPEs.
- Contrast traditional and structured PIPEs.
- Explain toxic PIPEs.

4.3.6: Demonstrate knowledge of liquid alternatives in the private equity sector.
Including:

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

4.3.7: Demonstrate knowledge of long-hold buyout funds.
Including:

- Identify the types of funds and assets likely to be held for 15 to 20 years.
- List the benefits and drawbacks of long-hold buyout funds.

The following is a review of the Real Assets principles designed to address the learning objectives set forth by CAIA Association®. Cross-reference to CAIA Association Reading 3.1.

READING 3.1

NATURAL RESOURCES AND LAND

Topic 3

EXAM FOCUS

This reading examines real assets, including natural resources, land purchased for development, timberland, and farmland. For the exam, understand the characteristics, risks, and returns of each of these alternative assets. Also, know the investment vehicles and methods of obtaining exposure to these alternative asset classes. Furthermore, it is important to understand that the market for real assets is thin (i.e., low transaction volume). As a result, real assets are often valued using the appraisal method, which means prices are stale, resulting in smoothed returns. Finally, know the historical performance of timberland and farmland, including their performance relative to world equities.

NATURAL RESOURCES

LO 3.1.1: Demonstrate knowledge of natural resources other than land.

Including:

- **Discuss natural resources as an exchange option.**
- **Discuss the concept of moneyness as it pertains to the development of natural resources.**
- **Discuss why some in-the-money development options should not be immediately exercised.**
- **Describe the relationship between the moneyness of natural resource options and short-term financial risks.**

Real assets are associated with investments that directly control nonfinancial assets and represent actual rights to consumption rather than indirect financial claims (i.e., **financial assets** such as stocks and bonds) to cash flows generated by the tangible and intangible assets of a firm.

Natural resources are a form of real assets that are still in their raw form and original location. Examples of natural resources include mining locations, water, wind, undeveloped land, and timberland. Commodities are often created by removing or transforming natural resources (e.g., oil fields are a natural resource and extracted oil is a commodity).

Many natural resources are subterranean (i.e., located below the surface of the earth). In the United States, private land ownership often includes both surface and underground rights. In addition, some states allow split estates. **Split estate** refers to estates where the surface rights to a property are owned by a different party than the rights to the minerals underneath the surface. However, many countries limit private land ownership to the surface, while governments retain possession of the mineral and energy natural resources located below the surface. Owners of the subterranean rights to a land parcel typically lease these rights (rather than sell the property) to developers to extract the natural resources.

Institutional investors interested in a portfolio allocation to natural resources can purchase pure play investments, subterranean mineral rights, and surface land that includes subterranean mineral rights, or lease mineral rights.

A **pure play** investment refers to a direct investment that only contains the risks and earns the returns of the underlying asset. For institutional investors, it can be difficult to locate a pure play investment in the natural resources sector due to the ownership issues mentioned previously (i.e., government ownership and private ownership that include surface rights). However, a few pure play natural resource investments exist, such as *Natural Resource Partners* (NRP). NRP is a publicly traded master limited partnership that primarily owns US mineral rights. However, even this investment is not completely a pure play as it earns approximately 10% of its revenues from equity and unconsolidated investment income.

Natural Resources as Exchange Options

An **exchange option** is an option to exchange one risky asset for another risky asset. The capacity to convert natural resources into commodities can be considered an exchange option. Similar to a call option, an investor in an exchange option must pay the strike price. However, the strike price for exchange options is often uncertain for natural resources. This is because the

money and resources required to convert the natural resource into a commodity are not known with certainty before the conversion. In option terminology, the inputs to the strike price would be considered the *deliverables*, and the resulting output (i.e., commodities) would be the *receivables*.

Figure 3.1A: Natural Resources Exchange Option Example

Deliverables (Costs Incurred by Option Buyer)	Receivables (Received by Option Buyer)
■ Mineral rights costs	■ Commodities
■ Equipment costs	
■ Labor costs	
■ Material costs	

For example, an investor who owns the mineral rights to gold has the option to incur costs, such as labor, equipment, and so on, to extract (take a long position in the underlying asset) gold. Because both the extraction costs and the value of commodities are stochastic (i.e., randomly distributed and unable to be accurately estimated), the value of the option varies over time based on three factors:

Correlation between the prices of deliverables and receivables

Volatility of the deliverables' prices

Volatility of the receivables' prices

These factors are the same as those identified by Markowitz in his work regarding an equally weighted two-asset portfolio.

Figure 3.1B: Influence on Price of Exchange Option

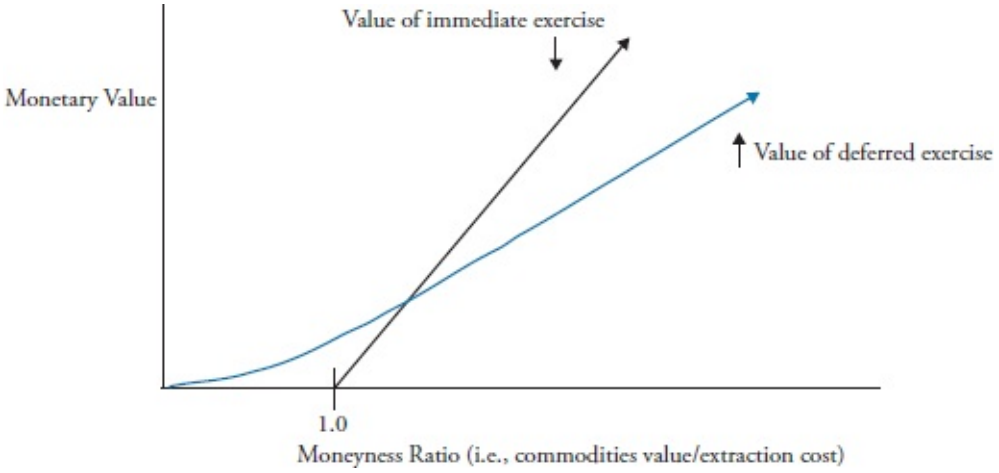
Factor	Impact on Option Price
Correlation	Higher correlation decreases option value
Volatility of Inputs	Higher volatility increases option value
Volatility of Outputs	Higher volatility increases option value

Natural resource development options can be either American or European style. American options can be exercised throughout the life of the option, while European options can only be exercised on the expiration date of the option. Some development options have a specific date of expiration, while most natural resource development options never expire (i.e., **perpetual options**). Perpetual options must, by definition, be American options.

Moneyness refers to whether an option is *in the money* or *out of the money*. If the immediate exercise of the option would generate a positive payoff, it is in the money. If immediate exercise would result in a loss (negative payoff), it is out of the money. When the current asset price equals the exercise price, exercising will generate neither a gain nor loss, and the option is *at the money*.

The lack of an expiration date for a perpetual option increases the complexity of the decision of when to exercise. While the option must be in the money for exercise, the amount by which it must be in the money to make exercise worthwhile is more complicated to determine and relies on the three factors mentioned previously (correlation, input price volatility, and output price volatility). In the following figure, moneyness is based on the ratio of the receivables price relative to the deliverables cost. As the price of the receivables increases relative to the cost of the deliverables, the option's moneyness increases and exercise becomes more likely.

Figure 3.1C: Moneyness of a Natural Resource Option



Delaying Option Exercise

We define the **intrinsic option value** (or *exercise value of an option*) as the maximum of zero and the amount that the option is in the money. That is, the intrinsic value is the amount an option is in the money (if it is in the money) or zero (if the option is at or out of the money). The intrinsic value is also the exercise value, the value of the option if exercised immediately.

Before expiration, an option has time value in addition to any intrinsic value. The **time value of an option** is the amount by which the **option price**

(premium) exceeds the intrinsic value and is sometimes called the speculative value of the option. This relationship can be written as:

option price = intrinsic value + time value

In traditional option theory, options are generally not exercised before expiration. However, returning to Figure 3.1C, we can see that the options that are deep in the money (high intrinsic option value) possess a negative time value. That is, the holder of the option is likely to experience the greatest benefit by immediately exercising the option. In terms of exercise timing, a natural resource exchange option is similar to an American put option. Conversely, a deep out-of-the-money option has zero intrinsic value, but a positive time value.

Moneyness and Financial Risks

When a developer has multiple options that could be exercised, it is crucial to first exercise the one with the highest benefit to cost ratio (i.e., the option that is most in the money). This is known as the **low-hanging fruit principle** and can be summarized as first developing the options that have the lowest opportunity cost relative to their benefits. In natural resource development, the low-hanging fruit principle is applied by analyzing all estimated costs of development for each option (e.g., legal costs, environmental remediation costs, extraction costs, and transportation costs). Note that technological innovation can result in a shift in the cost of deliverables, so opportunity costs can vary greatly over different periods and change the order in which a given set of options should be exercised. As a result, options that are unlikely to be exercised for a long period are most exposed to risks related to the cost of deliverables.

LAND

LO 3.1.2: Demonstrate knowledge of land as an alternative asset.

Including:

- **Describe the three types of land lots (i.e., paper lots, blue top lots, and finished lots).**
- **Discuss investment in undeveloped land as a call option.**
- **Apply the binomial option pricing technique for valuing land as a call option.**
- **Describe the risks and returns of investing in land.**
- **Calculate the expected return of land investments.**

Raw land (i.e., undeveloped or unimproved land) is a real asset that is not currently being used to generate a scarce resource, such as recreation, crops, or

shelter. The value of raw land lies in the future consumption that will arise because of its development. Raw land is sold with both the rights to improve and the rights to the natural resources beneath the surface of the land (e.g., mineral rights) in some jurisdictions. In other jurisdictions, the two potential sources of value are titled separately.

Land Banking

Some investors purchase raw land to develop it in the future. This is called **land banking**. These investors buy land for the sole purpose of selling it to homebuilders in the future. The value increases if the location is in the path of future development, residential growth, or both. Thus, raw land near metropolitan areas is more valuable and expensive than undeveloped land that is far from existing development. Improved lots that are held by third parties but are optioned by homebuilders for future use are also classified as land banking.

Land is categorized based on the level of existing improvements that have been made. Land that may be purchased for investment is classified as one of the following:

Raw land. These lots have no apparent signs of development, and there may be no zoning or permits for development.

Entitled lots. Similar to raw land, these lots have little to no physical improvements. The difference is that entitled lots have satisfied all local regulatory requirements for development.

Paper lots. These lots are vacant but have zoning approval for development.

Blue top lots. The development process has begun for these lots, including rough grading of the property and interim drainage and erosion controls. Some development fees as well as building permit fees have not been paid.

Finished lots. These lots are ready for construction, with all development fees paid. What remains is the payment for the building permit and the property inspection.

Broken lots. These lots underwent pre-development work, but that work was never finished, leaving them in a state of disrepair.

Historically, builders purchased and inventoried lots for future use. However, as building companies have grown in size and sophistication, they have increasingly relied on third parties to bank land on their behalf. Institutional

investors now provide lots to homebuilders across the full spectrum, from unfinished to ready for construction.

Land investing is a long-term strategy. Investors seek properties that can be purchased at an attractive price relative to the property's value as a finished project. The time from investment in the land to the finished project can be years.

Key risks that investors face in undeveloped residential land are:

Type. The more potential uses a piece of land has, the more valuable it is. Therefore, single-use properties are typically more risky.

Location. For example, lots in the path of future development and those closer to cities and suburbs are more valuable than those in rural areas. Therefore, rural properties typically have a higher level of risk.

Land as a Call Option

Investors in undeveloped land are, in essence, buying a call option on development. The components of a call option are:

Strike or exercise price. The strike price consists of construction and other costs required for developing the land (e.g., consider the cost of developing the land and constructing a duplex). The strike price is correlated with the price of the improved real estate (i.e., the excess value of the finished real estate project versus the costs of construction to develop the land).

Underlying asset. The underlying asset is a combination of the land and the improvements that are made to develop the land (e.g., a duplex and the land on which the duplex sits).

Option payoff. The payoff of the option is the difference between the value of the completed project (i.e., the value of the underlying asset) and the cost of developing and constructing the project (i.e., the strike price).

Exercising the option. The option will be exercised (i.e., the property will be developed) when the expected income from the developed property exceeds the value of retaining the option to develop the property.

Moneyness. If the value of the underlying asset is greater than the strike price, the option is in the money, and if the value of the underlying asset is less than the strike price, the option is out of the money. The volatility of the spread between the asset value and the strike price, the income yield of the completed

project, the risk-free rate, and the costs of holding the property, such as taxes and insurance, all affect the value of the option.

With traditional call options on stocks, the strike price is fixed. However, with land, the strike price can increase or decrease. This is because the cost of construction is positively correlated with the price of the improved property. Increasing real estate prices draw new builders into the market. This, in turn, pushes the price of construction materials and services up as demand increases.

If land has mineral rights associated with it, the opportunities are similar. The cost of mining and refining the minerals is the strike price. The refined minerals are the underlying assets. The value of land with mineral rights is likely higher than land purchased solely for development because the volatility of metal and energy prices increases option values.

Binomial Option Pricing for Valuing Land as a Call Option

An investor can analyze the value of developing land using single or multiperiod binomial option pricing models. In a **binomial option pricing model**, there are only two possible outcomes: an upward movement or a downward movement, with a risk-neutral probability of each outcome occurring. **Risk-neutral probabilities** assume that investors are risk neutral (i.e., indifferent to varying levels of risk given a level of return) and therefore are not necessarily real-world probabilities. Using risk-neutral probabilities allows risky assets to be discounted using a risk-free rate of return. Assuming a 0% risk-free rate and a one-period model simplifies the analysis. An important difference from the binomial tree option models covered previously is that the downward node for land options can have non-zero values.

> **EXAMPLE: Land as a binomial option**
>
> Arch Faley, a real estate developer, is considering an investment in a piece of undeveloped land. Faley would like to estimate the value of the option to develop the land using a binomial option pricing model approach. He assumes a 0% risk-free rate of interest and will use a single-period model. Faley determines that if the economy weakens, the cost of construction will be $200,000, but the value of the finished project will be $175,000. If the economy strengthens, the cost of construction will increase to $250,000, but the value of the completed project will be $340,000. Faley conducts an analysis of comparable finished projects in the region and finds they are

selling for $208,000. **Calculate** the value of the option to develop the property.

Answer:

Step 1:

Use the values of comparable projects and the up movement and down movement values to determine the risk-neutral probability that the economy will strengthen. If the risk-free rate is zero, there is no need to discount cash flows back to the present. Also, with a zero rate, the ending value of the property based on risk-neutral probabilities will be equal to the current value (i.e., the value of comparable improved properties in the market):

$$\text{current value of improved properties} = (\text{UpVal} \times \text{UpProb}) + [\text{DownVal} \times (1 - \text{UpProb})]$$

where:

UpVal = value in an improved or up state of the economy

DownVal = value in a worsened or down state of the economy

UpProb = risk-neutral probability of the up state

(1 − UpProb) = risk-neutral probability of the down state

Inserting the comparable property value and the value given an up or down state, we solve for the up probability as follows:

$$\$208{,}000 = (\$340{,}000 \times \text{UpProb}) + [\$175{,}000 \times (1 - \text{UpProb})]$$

$$\$208{,}000 = \$340{,}000 \times \text{UpProb} + \$175{,}000 - 175{,}000 \times \text{UpProb}$$

$$\$208{,}000 - \$175{,}000 = \$340{,}000 \times \text{UpProb} - 175{,}000 \times \text{UpProb}$$

$$33{,}000 = 165{,}000 \times \text{UpProb}$$

$$33{,}000 / 165{,}000 = \text{UpProb}$$

$$0.2 = \text{UpProb}$$

Therefore, the UpProb is 20% (or 1/5), and the down probability (1 − 0.20) is 80% (or 4/5).

Step 2:

Next, find the value of the project in either state of the economy (i.e., up or down). The value of the option is then the weighted-average value based on the probabilities of the up and down states:

$$\text{option value}_{\text{up state}} = \$340{,}000 - \$250{,}000 = \$90{,}000$$

$$\text{option value}_{\text{down state}} = \$175{,}000 - \$200{,}000 = -\$25{,}000$$

In the case of a loss, the investor would allow the option to expire unexercised (i.e., would not undergo construction) so it would be worth zero.

Using this information, the value of the option is calculated as:

option value = ($90,000 × 0.2) + ($0 × 0.8) = $18,000

Additional Scenarios

Once the probabilities have been calculated, the investor can perform scenario analysis. For example, assume construction costs are not positively correlated with improved property values, but are instead fixed. If construction costs are fixed at $210,000 (the original expected value), then the value of the option rises to:

($340,000 − $210,000) × 0.20 = $26,000

Volatility of the value of the underlying asset also increases the value of an option. This is because the upside potential is increased, but the limited downside (i.e., allowing the option to expire unexercised) prevents an increase in the potential loss. For example, holding the previously calculated 20% risk-neutral up-state probability constant, assuming that the property is worth $400,000 in an up economy and only $150,000 in a down state, the option value increases to:

($400,000 − $250,000) × 0.20 = $30,000

This is a simplified, one-period, 0% risk-free rate example. The analyst could increase the complexity of the model by making alternative interest rate assumptions (which would require discounting future cash flows) or choosing a multiperiod model.

Risk and Return of Land

Raw land is a risky investment because it does not provide the investor with an annual cash flow and generally requires a longer holding period. However, it does not require constant maintenance, as developed properties do, and it typically does not lose value over time the way some developed properties do.

The expected return of land is a probability-weighted average of the expected returns if the land is developed or not developed. For example, assume there is a 15% chance that a parcel of land will be developed and an 85% chance that it

will not be developed. If developed, the return is expected to be 30%. If not developed, the return is expected to be 4%. The probability that a property will be developed affects the expected return on the investment. The expected return on the land is:

$$E(R) = [P_d \times E(R_d)] + [(1 - P_d) \times E(R_{nd})]$$

where:
P_d = probability of developing land
$E(R_d)$ = expected return of developed land
$E(R_{nd})$ = expected return of undeveloped land

Thus, the expected return on the land is:

$$E(R) = (0.15 \times 0.30) + (0.85 \times 0.04) = 7.9\%$$

Some analysts argue that undeveloped land is a poor investment because prices do not increase substantially over time. However, the returns to developed land are higher. Land that has not been developed was likely a bad investment (i.e., investors let the call options expire unexercised). Thus, if analysts only consider the returns to properties that were never developed, they are understating the expected returns to all undeveloped land investments by virtue of ignoring the returns on the properties that were developed (the winners). This is an indication of **negative survivorship bias**, which is illustrated in the following example.

EXAMPLE: Negative survivorship bias

Assume that an equally weighted undeveloped land index exists. Last year, 10% of the properties used as components in the index were developed and removed from the index. During this period, developed properties increased in value by 10%, while undeveloped properties increased in value by 3%. **Calculate** the negative survivorship bias for this index.

Answer:

The return on the index is 3%. However, the actual return of all the properties originally contained in the index is calculated as follows:

$$(0.90 \times 0.03) + (0.10 \times 0.10) = 3.7\%$$

Therefore, the return on the index has a negative survivorship bias of 0.7% (= 3.7% − 3%).

PROFESSOR'S NOTE