UpperMark™ Study Handbook

CAIA® Level I

Volume 2

Topic 3: Real Assets

Topic 4: Private Equity

Topic 5: Private Debt

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Preface

Volume 2 of the UpperMark™ *Study Handbooks* provides a comprehensive and concise account of each learning objective (L.O.) in Topics 3-5 of the CAIA Level I Study Guide. The *Study Handbook* is compiled using the reference materials recommended by the CAIA Association and, as in Volume 1, is organized as follows.

- Each Reading in the Study Guide is presented as a separate chapter, keywords are indicated in ***bold italics***, and learning objective sub-bullets are indicated by underlined, capitalized subheadings (e.g., ROLE OF INVESTMENT OBJECTIVES AND CONSTRAINTS).
- The lists of learning objectives and keywords are provided at the start of each chapter.
- Space is provided at the end of each chapter for you to record your *Personal Study Notes*.
- A set of sample exam questions with a detailed answer key is presented at the end of each chapter.

Supplementary information is included in footnotes.

We wish you the best with your exam preparation.

Padideh Jalali, Ph.D., CAIA
President and CEO
UpperMark, Inc.

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Topic 3

Real Assets

Topic 3 comprises five chapters on real assets, which are economic resources that create or add to consumption opportunities (in contrast to financial assets that are conduits of value).

1. Reading 3.1 discusses natural resources, land, timberland, and farmland as alternative assets.
2. Reading 3.2 covers investing in commodities and components of commodity investing.
3. Reading 3.3 discusses operations related to other real assets (e.g., commodity-producing firms, infrastructure, and intellectual property).
4. Reading 3.4 reviews real estate, including different investment styles and real estate sectors.
5. Reading 3.5 discusses real estate assets, and describes forms of financing and real estate investment vehicles for private market commercial real estate.
6. Reading 3.6 describes real estate valuation methods.

Reading 3.1

Natural Resources and Land

This Reading discusses institutional-quality investments in natural resources and land, with a focus on undeveloped land, timberland, and farmland. The Reading also reviews historical performance of timberland and farmland.

Learning Objectives

3.1.1 Demonstrate knowledge of natural resources other than land.

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

Keywords

1. Exchange option
2. Pure play
3. Split estate

3.1.2 Demonstrate knowledge of land as an alternative asset.

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

Keywords

1. Binomial option pricing
2. Blue top lots
3. Broken lots
4. Entitled lots
5. Finished lots
6. Land banking
7. Negative survivorship bias
8. Paper lots
9. Raw land
10. Risk-neutral probability

3.1.3 Demonstrate knowledge of timber and timberland as alternative assets.

i. Discuss the characteristics of timber and timberland
ii. Discuss the role of timberland investment management organizations (TIMOs)
iii. Describe the risks and returns of timberland investments
iv. Identify methods of gaining exposure to timberland
v. Explain benefits and disadvantages of timber investment

Keyword

1. Timberland investment management organizations (TIMOs)

3.1.4 Demonstrate knowledge of farmland as an alternative asset.

i. Discuss the characteristics of farmland investments
ii. Calculate the value of farmland based on annual operating income and the cap rate
iii. Understand the structure of farmland ownership and management
iv. Discuss supply and demand factors of agricultural products
v. Identify three key benefits and three key disadvantages of farmland investment

vi. Identify methods of obtaining exposure to farmland
vii. Discuss the value and importance of assets with multiple purposes

Keywords

1. Agency risk
2. Cap rate

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

i. Discuss the reliability of market prices versus appraisal-based data
ii. Define contagion

Keyword

1. Contagion

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

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

L.O. 3.1.1 **DEMONSTRATE KNOWLEDGE OF NATURAL RESOURCES OTHER THAN LAND.**

Natural resources are real assets that have not or barely been altered by human activity. Examples include undeveloped land, timberland, and raw materials (e.g., oil, natural gas, coal, water, and wind) provided by or part of the earth that generally remain in a natural state and location. Commodities are not classified as natural resources by the CAIA text, since commodities are typically processed or otherwise modified.[2]

Many natural resources are used as inputs in production processes, with most related to energy production due to energy's role in the global economy. For instance, energy consumption represents 8%–10% of the U.S. gross domestic product. Other large sectors of natural resources include land and metal ores.

Most natural resources are under the earth's surface. Globally, most private land ownership is limited to surface rights, with subsurface rights (e.g., mineral and energy) owned by governments.

- An exception is in the U.S., where private land ownership typically includes mineral rights. In the case of privately-held land, some U.S. states permit ***split estates***, which entails surface and subsurface rights being owned by different parties.
- Owners of natural resources typically lease the natural resource rights to operating firms for resource development and extraction. Thus, effective economic ownership of natural resources is often attained by buying or leasing rights (not by direct property ownership).

Institutional ownership of natural resources may be achieved through land ownership that includes underground rights, ownership of mineral rights, or leasing of mineral rights.

While most global natural resources are owned by governments or leased to operating firms, some opportunities for ***pure plays*** (i.e., investment vehicles that provide direct exposure to an investment's risks and returns without exposure to other risks) on natural resources exist through private partnerships or listed partnerships (MLPs).

- Pure plays on private investments in natural resources are not common. Most underground natural resources are not privately owned and most U.S. privately-owned natural resources are combined with surface rights. Therefore, few institutional-quality investments have returns based almost entirely on the values of underlying natural resources.
- A public market example of a somewhat pure play on natural resources is Natural Resource Partners LP (with ticker NRP on NYSE), an MLP that owns, manages, and leases mineral reserve properties, including coal, industrial materials, and other natural resources in the U.S.
  - NRP's performance during the global financial crisis was similar to that of the overall market; however, its subsequent performance is linked to potential profits from its coal properties. This exemplifies the issue of using public markets to access pure plays on natural resources. Further, lack of publicly-traded investments limits the evidence on market prices of natural resource investments.

[2] Commodities are discussed in Reading 3.2.

NATURAL RESOURCES AS AN EXCHANGE OPTION

Developing a natural resource involves acquiring mineral rights and using equipment, materials, labor, fuel, and management to extract a real asset or commodity and bring it to market. Prices of deliverables (i.e., mineral rights and production inputs) and receivables (i.e., processed natural resources) are both stochastic. Costs of developing natural resources change due to factors such as technological advances and environmental and regulatory issues.

Since developers exchange production inputs to retrieve real assets, natural resources may be characterized as ***exchange options***, which are options to exchange one risky asset for another (i.e., production inputs for processed natural resources) at a stochastic strike price. This contrasts with standard options that provide the right to buy or sell an asset at a fixed strike price.

- The value of an exchange option (like all options) depends on volatility. In the case of an exchange option, volatility depends on the following.
  1. Volatility of the delivered asset(s)
  2. Volatility of the received asset(s)
  3. Correlation between the two prices in 1 and 2.
- The volatility of the exchange option can be described as the volatility of a two-asset portfolio. If development costs and commodity prices are not highly positively correlated, all else equal, the option value and its volatility are high. However, the option is considerably less valuable when development costs and commodity prices are highly correlated.

MONEYNESS AS A FACTOR IN DEVELOPING NATURAL RESOURCES

The payoff diagram for development of natural resources as an option is depicted in Figure 1. As indicated, the payoff resembles that of a call option, with a number of exceptions.

- The horizontal axis in Figure 1 represents the ratio of the price of the developed real asset to the cost of developing the natural resource. Since the price of a developed natural resource and the cost of developing the resource are both stochastic, the option's moneyness depends on the spread between development benefits and costs.
- Thus, moneyness reflects the benefit-cost ratio of developing the natural resource, with the three categories of moneyness indicating the following about the benefit-cost ratio.
  - In-the-money (ITM – Benefit-cost ratio is greater than one, which means that revenues from selling the commodity exceed costs of developing the commodity.
  - At-the-money – Benefit-cost ratio equals one.
  - Out-of-the-money (OTM) – Benefit-cost ratio is less than one.

The option to develop rights to a natural resource is generally a perpetual option or may be leased on a temporary basis.[3]

- In theory, most options should be held until expiration (except deep-ITM puts and calls prior to ex-dividend dates, which should be exercised early). Since, as a perpetual option, a development option has no expiration date, the option holder needs to decide when to exercise the option.

[3] A perpetual option is an American option with no expiration date. American options can be exercised at any time before or at expiration; whereas European options can only be exercised at expiration.

- A natural resource should only be developed (i.e., the option exercised) when the option is substantially ITM.
  - How far ITM the option should be to justify it being exercised is governed by option theory and depends on three factors: volatility of the commodity price, volatility in the cost of extracting the commodity, and correlation between the two volatilities.
  - As indicated in Figure 1, above point X, the option value is greater if the option is exercised immediately than if the decision to exercise is deferred. In other words, in that range, developers generate more wealth by immediately developing the natural resource than delaying development.
  - Therefore, the development option is adequately ITM and should be exercised at values at and above point X.

Different natural resource properties have different development benefit-to-cost ratios. The order in which these properties are developed is typically governed by the low-hanging-fruit principle, which states that the development project with the highest benefit-to-cost ratio should be undertaken first. For instance, a property rich in a mineral and located in a jurisdiction supportive of development is deep ITM and should be mined before a similar property that has low concentrations of the mineral and strict environmental regulations.

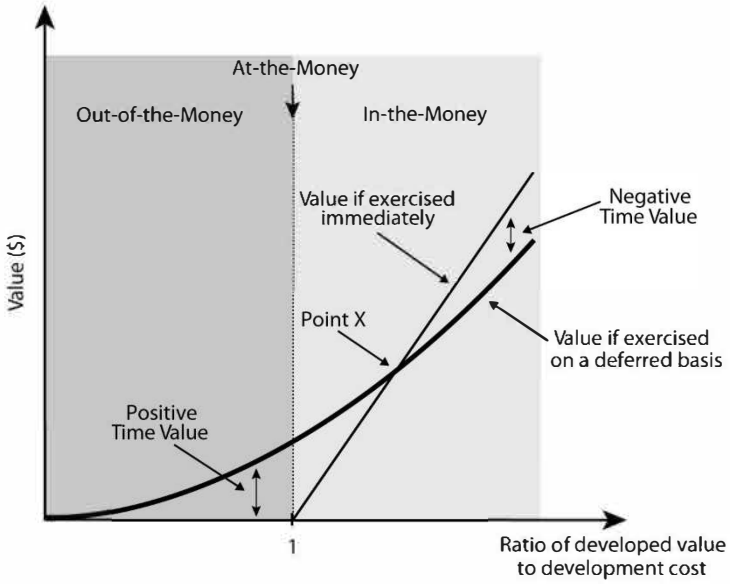

Figure 1: Payoff Diagram for Natural Resource Development Call Option

WHY SOME ITM OPTIONS SHOULD NOT BE EXERCISED IMMEDIATELY

The value of delaying a decision to exercise ITM options is based on the time value of money and assessing the benefit of waiting for new information. Thus, to determine the optimal time to exercise an option, option holders consider the benefit generated by volatilities of market prices and the option's convexity.

- The convex nature of an option's payoff diagram represents the asymmetric nature of the option's payoffs: long option positions increase in value at an increasing rate (going from left to

right on the payoff diagram; i.e., as the benefit-to-cost ratio in Figure 1 increases) and decrease in value at a decreasing rate in the other direction.

- Not exercising an option immediately gives the option holder a chance for the option to become more valuable or become less valuable (possibly out-of-the-money [OTM]) but with the possibility of later increasing in value.
  - For instance, consider an option with an intrinsic value of $50. If the option's moneyness increases, its intrinsic value may increase to $110. However, if its moneyness decreases by the same amount (i.e., $60), the option's intrinsic value will only decline to $0 (it will not decline to –$10). Therefore, if the option holder has a reasonably good chance of receiving $110 or receiving an OTM option that may become valuable in the future, he would be reluctant to exercise the option.

MONEYNESS OF DEVELOPMENT OPTIONS AND SHORT-TERM FINANCIAL RISKS

Factors that drive short-term financial risks of natural resources development options depend on whether the options are far ITM or OTM.

- Far-ITM development options
  - Risks of these options are primarily driven by the underlying commodity price.
  - Figure 1 shows that the option curve has a steep slope when options are far ITM, which suggests that changes in commodity price are the leading source of short-term volatility in the option value.
  - The greater the option's moneyness, the shorter the time before the option is exercised and the lower the chance that the option's price will change significantly due to changes in development costs.
- OTM development options
  - These options are sensitive to factors other than the underlying commodity price. The longer the time horizon for possible development, the greater the sensitivity of the natural resource's price to changes in development costs, interest rates, and other factors.

L.O. 3.1.2 DEMONSTRATE KNOWLEDGE OF LAND AS AN ALTERNATIVE ASSET.

Land, in economic terms, is a real asset whose value is strongly tied to its ability to generate valuable resources such as food, shelter, or timber. Most of the world's land is currently undeveloped and must be valued according to its potential to be productive. In addition, rights associated with land ownership vary by governmental jurisdiction. Claims to natural resources under the land (e.g., minerals) may be titled separately from the land.

Land development value chain

Land banking involves investing in undeveloped land in the hopes of price appreciation or for the purpose of development. Homebuilders, for instance, buy lots of land for future home developments. Key risks and land values are determined by the location of the land and the extent to which it has been developed or improved.

TYPES OF LAND LOTS

Land must complete several stages of preparedness or improvement before it can be developed. Its value, all else equal, should increase from one level of improvement to the next. A value chain for land or lots may be viewed as follows.

1. ***Raw land*** – This type of land has no obvious signs of development. It may be clear of trees and brush, but it is not prepared for development. It may also lack zoning or permits required for development.
2. ***Paper lots*** – These are vacant plots of land that have been approved for development by the local zoning authority, but construction of infrastructure (e.g., streets and utilities) has not yet begun.
3. ***Entitled lots*** – These have little/no physical improvements, but have met all local regulatory requirements for development (e.g., zoning, permitting, surveys, entitlements, assessments, and other aspects of the planning stage).
4. ***Blue top lots*** – These are lots for which construction has begun but that are not yet ready for homebuilding. This means infrastructure has begun to take form. The rough grading of the lots has been completed, including undercutting the street section and interim drainage facilities, and required fees have been paid. At this stage, a homebuilder can obtain a building permit.
5. ***Finished lots*** – These lots are completely ready to begin construction of a home or building. They are the final stage of the value chain. All entitlements are complete, including grading, utilities, and other infrastructure for the lot, streets, and common areas. Development fees (except building permits and inspections) have been paid.

Some investment strategies may purchase raw land and navigate up the value chain with the objective of reselling it for a high value to an investor who wants to develop it. In some cases, typically due to economic hardship, the result may be a ***broken lot***, which is lot that has had some pre-development (e.g., grading and infrastructure), but has not been completed and has fallen into disrepair.

Development requires significant time and costs, which makes land investment a risky, long-term strategy. The greater the cost of preparing the lot for homebuilding, the riskier the investment. Thus, finished lots near a metropolitan area are safer investments than paper lots and lots far from metropolitan areas, and unfinished lots are sold at discounts to their potential value.

Advancements in land banking have promoted the efficient flow of capital among players in the undeveloped land market. In the past, homebuilders would buy land strictly for their own use in development. Now, it is not uncommon for a third party to bank land for development companies. In fact, homebuilders increasingly rely on institutional investors to hold and provide paper lots and finished lots when needed.

INVESTING IN UNDEVELOPED LAND – A CALL OPTION

Like investing in land with mineral rights, investing in undeveloped land may be viewed as a call option on development. The value of the call option depends on a number of factors.

1. Underlying asset – The land and its development/construction or improvement
2. Strike price – Cost of development or improvements (i.e., building a house)

3. Time to expiration – Typically unlimited
4. Payoff – The spread between the value of the completed development and the cost of development
   - The value of a call option is positively correlated with the payoff. In other words, the value of land increases as the potential payoff increases.
5. Volatility – The volatility of the spread between the value of the completed development and the cost of development/construction
   - The value of land is positively correlated with the anticipated volatility in the potential payoff.
   - Development costs are also positively correlated with the value of the completed project, since more developers enter the market as prices rise, which results in higher prices of materials used in construction. This positive correlation implies that the option value may instead decrease as the expected sales price increases (if the construction costs rise faster than the expected sales price).
6. Risk-free rate
7. Dividend yield (i.e., income) of completed project
8. Costs of holding undeveloped land (e.g., maintenance, taxes, and insurance)

Land is a perpetual call option that should be exercised (i.e., the land should be developed) when the net benefits of development exceed the value of keeping the option. The decision to develop land depends on the moneyness of the option and can be modeled using option theory. All else equal, a unit of land is more valuable and has higher expected payouts if it can be used for multiple purposes, as long as the values to the purposes are not perfectly correlated.

VALUING LAND AS A CALL OPTION – BINOMIAL OPTION PRICING

Binomial option pricing is a technique that constructs a series of binomial trees, where each node has two outcomes corresponding to two states of the economy (e.g., economy improves or weakens). The current value of the option is determined as an average of the outcomes, each weighted by the probability of its occurrence.

The binomial tree for the value of an instrument is shown in Figure 2. Each node in the tree represents a level of the instrument's value. The initial node represents the current value, V_0, and nodes V_u and V_d represent the two values at the end of period 1 that correspond to up and down moves, respectively, in the economy.

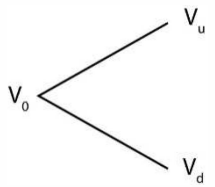

Figure 2: Binomial Tree