The following is a review of the Alternative Investments for Portfolio Management principles designed to address the learning outcome statements set forth by CFA Institute. This topic is also covered in:

ALTERNATIVE INVESTMENTS PORTFOLIO MANAGEMENT

Study Session 13

EXAM FOCUS

This topic assignment provides an overview of major types of alternative investments and their roles in portfolio construction. Be prepared for questions relating to: 1) common elements and differences among alternative investments; 2) available benchmarks and measurement challenges; 3) strategies and role in the portfolio; and 4) due diligence issues. This is qualitative material so expect questions focusing on recall and understanding concepts.

ALTERNATIVE INVESTMENT FEATURES

LOS 31.a: Describe common features of alternative investments and their markets and how alternative investments may be grouped by the role they typically play in a portfolio.

CFA® Program Curriculum, Volume 5, page 7

Alternative investments offer diversification benefits and the potential for active management. There are six basic groups. Traditional alternative investments include real estate, private equity, and commodities. The more modern alternative investments include hedge funds, managed futures, and distressed securities.

Alternative investments can also be grouped by their role in portfolio management:

1. Real estate and long-only commodities offer exposure to risk factors and return that stocks and bonds cannot provide.

2. Hedge funds and managed futures offer exposure to special investment strategies and are heavily dependent on manager skill.

3. Private equity and distressed securities are seen as a combination of 1 and 2.

1. The terminology used throughout this topic review is industry convention as presented in Reading 31 of the 2013 CFA Level III exam curriculum. Empirical results are referenced in that reading as well.
Alternative investments can be highly unique and there are differences of opinion on how to group them. But they do share some common features:

1. **Low liquidity.** Their general lack of liquidity requires careful attention to determine if they are suitable for a given investor. The alternative investment should also be associated with a liquidity premium and higher return.

2. **Diversification.** They generally have low correlation with and offer significant diversification to traditional stock and bond portfolios.

3. **Due diligence costs.** Costs associated with researching and monitoring alternative investments can be high. Specialized expertise and specific business skills are often required. These markets frequently lack transparency, making information difficult to obtain.

4. **Difficult performance evaluation.** The lack of transparency and unique features of many strategies make it difficult to identify appropriate valuation benchmarks.

### Due Diligence Checkpoints

**LOS 31.b: Explain and justify the major due diligence checkpoints involved in selecting active managers of alternative investments.**

The lack of transparency and unique strategies of many alternative investment managers makes due diligence in manager selection crucial:

1. **Assess the market opportunity offered.** Are there exploitable inefficiencies in the market for the type of investments in which the manager specializes? Past returns do not justify selecting a manager unless there are understandable opportunities available for the manager to exploit. (This one would have stopped anyone from investing with Bernie Madoff.)

2. **Assess the investment process.** What is the manager’s competitive edge over others in that market? How does the manager’s process identify potential opportunities?

3. **Assess the organization.** Is it stable and well run? What has been the staff turnover?

4. **Assess the people.** Meet with them and assess their character, both integrity and competence.

5. **Assess the terms and structure of the investment.** What is the fee structure? How does it align the interest of the manager with the investors? What is the lock-out period? Many funds do not allow withdrawals for an initial period. What is the exit strategy for redeeming the funds invested?

6. **Assess the service providers.** Investigate the outside firms that support the manager’s business (e.g., lawyers, brokers, ancillary staff).
7. **Review documents.** Review the prospectus or private-placement memorandum, the audits of the manager’s reports, and other available documents. Seek legal and other expert advice where needed.

8. **Write-up.** Document the above review process.

**ISSUES FOR PRIVATE WEALTH CLIENTS**

**LOS 31.c:** Explain the special issues that alternative investments raise for investment advisers of private wealth clients.

Institutional investors are presumed to be more knowledgeable and dispassionate investors. Individuals can be less knowledgeable, more emotional, and have real issues that must be considered to determine suitability.

1. **Taxes.** Most individuals must pay taxes. Many alternative investments are structured as limited partnerships which require specialized tax expertise.

2. **Suitability.** Many alternative investments require that funds stay invested for a minimum time period. Is this compatible with the investor’s time horizon and liquidity needs? What happens if the investor’s situation changes? Individuals may have emotional feelings that draw them towards or repel them from some investments.

3. **Communication.** Discussing complex strategies with the client is not easy. When a client is excited about a unique opportunity, how do you make sure they really do understand a ten-year lock-out means they cannot get the money back for ten years? How do you explain the diversification benefit of a very complex strategy to someone with no investment training?

4. **Decision risk.** This could be defined as the risk of emotionally abandoning a strategy right at the point of maximum loss. Carefully communicating the expected ups and downs of a strategy and being prepared for the emotional response to the downside is hard. Some strategies offer frequent small returns but the occasional large loss. They maximize the chance of an emotional investor making the wrong decision to cash out after a loss. Other strategies offer wild swings between large gains and losses with an attractive long term average return.

5. **Concentrated positions.** Wealthy individuals’ portfolios frequently contain large positions in closely held companies or private residences. Such ownership should be considered as a preexisting allocation before deciding to add additional private equity or real estate exposure. These existing positions may also have large unrealized taxable gains which add complexity to any rebalancing decision.

One approach to incorporating alternative investments into a traditional portfolio is core-satellite. The traditional core of the portfolio would remain as stocks and bonds to provide market exposure and return. However, it is difficult to add value in such efficient markets. More informationally inefficient alternative investments would be added to provide excess return (alpha) as the satellite.
**Alternative Investment Classes**

**LOS 31.d: Distinguish among the principal classes of alternative investments, including real estate, private equity, commodity investments, hedge funds, managed futures, buyout funds, infrastructure funds, and distressed securities.**

*CFA® Program Curriculum, Volume 5, page 13*

*Professor’s Note: You might notice the CFA text just switched from six groups to eight classes. That is because infrastructure funds are a subgroup of real estate and buyout funds of private equity.*

**Real Estate**

One way to classify real estate investment is between *direct* and *indirect*. Direct real estate investment includes ownership of residences, commercial real estate, or agricultural land. The ownership involves direct management of the assets. Indirect investment in real estate generally means there is a well-defined middle group that manages the properties. Indirect real estate investments include:

- Companies that develop and manage real estate.
- Real estate investment trusts (REITs), which are publicly traded equity shares in a portfolio of real estate. Equity REITs own and operate properties while mortgage REITs hold mortgages on real estate. REITs can be purchased in small sizes and are liquid.
- Commingled real estate funds (CREFs), which are pooled investments in real estate that are professionally managed and privately held, have more flexibility than REITs. They can be open-end and allow in new investors or closed-end and not allow in new investors after an initial offering period. They are restricted to wealthy investors and institutions.
- Separately managed accounts for wealthy investors are usually offered by the same managers who manage CREFs.
- **Infrastructure funds** specialize in purchasing public infrastructure assets (e.g., airports, toll roads) from cities, states, and municipalities. Because infrastructure assets typically provide a public service, they tend to produce relatively stable long-term returns. They tend to be regulated by local governments which adds to the predictability of cash flows. Their low correlation with equity markets means infrastructure assets provide diversification, and their long-term nature provides a good match for institutions with long-term liabilities (e.g., pension funds). Their relatively low risk, however, means that infrastructure returns are low.

The advantages of real estate investment typically include low correlation with stocks and bonds (providing a portfolio diversification benefit), low volatility of return, and often an inflation hedge. Real estate may also offer tax advantages and the potential to leverage return.

Disadvantages include high information and transaction costs, political risk related to the potential for tax law changes, high operating expenses, and the inability to subdivide direct investments. Real estate as an asset class and each individual real estate asset can have a large idiosyncratic risk component.
Private Equity

Private equity investment is an ownership interest in a non-publicly-traded private company. Legal restrictions generally limit ownership to high-net-worth individuals or institutions. Often, the investing is done through pooling funds with other investors in a private equity fund. There are numerous subcategories of private equity. The two most important are venture capital, which provides funding to start or grow a private company, and buyout funds, which provide funds to buy existing public companies from their shareholders and then take the company private.

Two important segments of buyout funds are middle-market buyout funds and mega-cap buyout funds. Middle-market buyout funds concentrate on divisions spun off from larger, publicly traded corporations and private companies that, due to their relatively small size, cannot efficiently obtain capital. Mega-cap buyout funds concentrate on taking publicly traded firms private.

Buyout funds add value through some combination of: 1) restructuring company operations and management, 2) buying companies for less than intrinsic value, and 3) creating value by adding leverage or restructuring existing debt of the company. The exit strategies include selling the companies through private placements or IPOs or through dividend recapitalizations. In a dividend recapitalization, the company (under direction of the buyout fund) issues substantial debt and pays a large special dividend to the buyout fund and other equity investors. The debt effectively replaces some or most of the equity of the company, while allowing the investors to recoup some or all of their original investment. Recapitalization increases the company’s leverage but does not change the owner. The buyout fund retains control but extracts cash from the company.

Private equity is a highly diverse class that typically involves high risk with a significant number of investments that fail. The venture capitalist is often expected to bring not only funding but business expertise to operate the company. The entrepreneurs who start the company often lack the capital and management skills to grow the company. The company may employ agents to solicit private equity investors through a private placement memorandum which describes the business plan, risk, and many other details of the investment.

Commodities

Commodity investments can include direct purchase of the physical commodity (e.g., agricultural products, crude oil, metals) or the purchase of derivatives (e.g., futures) on those assets. Indirect investment in commodities can include investment in companies whose principal business is associated with a commodity (e.g., investing in a metal via ownership of shares in a mining company). Direct investment through derivatives is more common as indirect investment has not tracked well with commodity price changes and direct investment by buying the commodities creates issues to consider such as storage costs.

Investments in both commodity futures and publicly traded commodity companies are fairly liquid, especially when compared to many other alternative investments. Investments in commodities have common risk features such as low correlation with
stocks and bonds and business-cycle sensitivity, and most have a positive correlation with inflation. These risk characteristics are the reasons commodities provide good diversification to an investor’s portfolio.

Hedge Funds

Hedge funds are a diverse group and the terminology used to describe them is flexible. Initially they were private pools of money that were both long and short the market. Hence, they were not exposed to market risk. Many hedge funds still target an absolute level of return that is not dependent on market returns. Hedge funds are generally structured to avoid regulation which also allows them to charge substantial incentive fees. Each fund is designed to exploit a perceived market opportunity, often taking both long and short positions on a leveraged basis. Many hedge funds describe themselves as exploiting arbitrage opportunities. In the case of hedge funds the term “arbitrage” is used very loosely to mean lower-risk and not to mean risk-free.

Hedge fund classifications include: equity market neutral, convertible arbitrage, fixed-income arbitrage, distressed securities, merger arbitrage, hedged equity, global macro, emerging markets, and fund of funds (FOF).

Professor’s Note: For a discussion of these terms see LOS 31.p.

Managed Futures

Managed futures funds are sometimes classified as hedge funds. Others classify them as a separate alternative investment class. In the United States, they generally use the same limited partnership legal structure and base fee plus performance fee compensation structure as hedge funds. A 2% base fee plus a 20% share of the profits is a common fee structure. Like hedge funds, they are often considered to be skill based and not an asset class, per se; they depend on the skill of the manager to find and exploit opportunities and as such have no inherent return and risk characteristics of their own.

The primary feature that distinguishes managed futures from hedge funds is the difference in the assets they hold. For example, managed futures funds tend to trade only in derivatives markets, while hedge funds often trade in spot and futures markets. Also, managed futures funds generally take positions based on indices, while hedge funds tend to focus more on individual asset price anomalies. In other words, hedge funds tend to have more of a micro focus, while managed futures tend to have a macro focus. In some jurisdictions they are more regulated than hedge funds.

Investment in managed futures can be done through: private commodity pools, managed futures programs as separately managed accounts (called CTA managed accounts), and publicly traded commodity futures funds that are available to small investors. Liquidity will be lower for private funds than for publicly traded commodity futures funds.
Trading strategies and classifications used include:

- **Systematic trading strategies** follow rules. Trend following rules are common and may focus on short-, medium-, or long-term trends. Contrarian strategies exist but are less common.
- **Discretionary trading strategies** depend on the judgment of the manager and could be based on economic or other criteria.
- Managed futures may invest in all financial markets, currency markets only, or a diversified mix of derivatives and underlying commodities.

The risk characteristics of managed futures will vary, as they do for hedge funds. A trend-following strategy will offer lower diversification than a contrarian strategy. The standard deviation of managed futures is generally less than that of equities but greater than that of bonds. The correlation between managed futures and equities is low and often negative. With bonds, the correlation is higher but still less than 0.50.

**Distressed Securities**

Distressed securities are securities of companies that are in or near bankruptcy. They are another type of alternative investment where the risk and return depend upon skill-based strategies. Some analysts consider distressed securities to be part of the hedge fund class or of the private equity class.

One way to construct subgroups in distressed securities is by structure, which determines the level of liquidity. The hedge fund structure for distressed security investment is more liquid. The private equity fund structure describes funds that are less liquid because they have a fixed term and are closed-ended. The latter structure is more appropriate when the underlying securities are too illiquid to overcome the problem of determining a net asset value (NAV).

Figure 1 presents a summary of alternative investment characteristics.
**Figure 1: Alternative Investment Characteristics**

<table>
<thead>
<tr>
<th>Types of Investments</th>
<th>Risk/Return Features</th>
<th>Liquidity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Real estate</strong></td>
<td>Residences; commercial real estate; raw land.</td>
<td>Large idiosyncratic risk component; provides good diversification.</td>
</tr>
<tr>
<td><strong>Private equity</strong></td>
<td>Preferred shares of stock; venture capital; buyout funds.</td>
<td>Start-up and middle-market private companies have more risk and lower returns than investments in established companies via buyout funds.</td>
</tr>
<tr>
<td><strong>Buyout funds</strong></td>
<td>Well-established private firms and corporate spin-offs.</td>
<td>Less risk than venture capital funds; good diversification.</td>
</tr>
<tr>
<td><strong>Infrastructure funds</strong></td>
<td>Public infrastructure assets.</td>
<td>Low risk, low return; good diversification.</td>
</tr>
<tr>
<td><strong>Commodities</strong></td>
<td>Agricultural products; crude oil; metals.</td>
<td>Low correlation with stocks/bonds. Positive correlation with inflation.</td>
</tr>
<tr>
<td><strong>Managed futures</strong></td>
<td>Tend to trade only in derivatives market. Private commodity pools; publicly traded commodity futures funds.</td>
<td>Risk is between that of equities and bonds. Negative and low correlations with equities and low-to-moderate correlations with bonds.</td>
</tr>
<tr>
<td><strong>Distressed securities</strong></td>
<td>May be part of hedge fund class or private equity class. Investments can be in debt and/or equity.</td>
<td>Depends on skill-based strategies. Can earn higher returns due to legal complications and the fact that some investors cannot invest in them.</td>
</tr>
</tbody>
</table>

**For the Exam:** The various types of alternative investment classes appear in several places throughout the curriculum. Hedge funds in particular are discussed several times and real estate receives more coverage than some of the other topics. Commodities are examined in greater detail later in this study session. You will be able to find small inconsistencies in the discussions so focus on the main points of agreement and be aware of areas that may be more controversial. The published topic weight for alternative investments is 5–15%.
**ALTERNATIVE INVESTMENT BENCHMARKS**

**LOS 31.e:** Discuss the construction and interpretation of benchmarks and the problem of benchmark bias in alternative investment groups.

*CFA® Program Curriculum, Volume 5, page 15*

**For the Exam:** Be ready to discuss the general properties, including the drawbacks, of alternative investment benchmarks.

Appropriate benchmarks for a given alternative investment manager can be difficult to establish. The following list describes the more common benchmarks available and some of the issues that arise.

- **Real estate** has the National Council of Real Estate Investment Fiduciaries (NCREIF) Property Index as its principal benchmark for direct investments. The NCREIF Index is a value-weighted index of commercially owned properties that uses samples based both on geographic location and type (e.g., apartment and industrial). The values are obtained periodically, usually by annual appraisal, so the volatility of the index is downward biased. The index is published quarterly.

  For indirect real estate investment, the primary benchmark is the National Association of Real Estate Investment Trusts (NAREIT) Index. The NAREIT Index is cap-weighted and includes all REITs traded on the NYSE or AMEX. Similar to other indices based upon current trades, the monthly NAREIT Index is “live” (i.e., its value represents current values).

  The biggest problem is the infrequent trading of most real estate investments and the resulting understatement of actual volatility. Various techniques have been used to unsmooth or “correct” this bias. The unsmoothed data raises the standard deviation and reduces the Sharpe ratio of real estate, making real estate less attractive but still a valuable addition to stock and bond portfolios due to its low correlation. Another problem is that many real estate indices reflect leveraged investments. When leverage effects are removed, returns and Sharpe ratios are lower, but the low correlation with other asset classes still leaves real estate as an attractive addition to portfolios. Finally, in the case of REITS, the returns are more correlated with equity while other types of real estate investment are less correlated with equity, meaning REITS offer less of a diversification benefit.

- **Private equity** indices are provided by Cambridge Associates and Thomson Venture Economics. Indices are constructed for the buyout and venture capital (VC) segments of the private equity markets. Because private equity values are not readily available, the value of a private equity index depends upon events like IPOs, mergers, new financing, and so on to provide this information. Thus, the indices might present dated values as repricing occurs infrequently. Note that private equity investors also often construct custom benchmarks.

  The primary problems are the lack of pricing data, forcing a heavy reliance on appraisal values for investments, and the resulting smoothing of returns and understatement of volatility. In addition, private equity shows a strong vintage year...
effect. The economic conditions of the year in which the fund was launched have a significant effect on subsequent performance for the life of the fund. As a result, comparisons are often made to other funds launched in the same year.

- **Commodity markets** have many indices for use as benchmarks. Most of them assume a futures-based strategy. For example, the Dow Jones-UBS Commodity Index (DJ-UBSCI) and the S&P Commodity Index (S&PCI) represent returns associated with passive long positions in futures.

The indices include exposures to most types of commodities and are considered investable. They can vary widely, however, with respect to their purpose, composition, and method of weighting the classes. Given the zero-sum nature of futures, the indices cannot use a market-cap method of weighting. Two methods of weighting are 1) basing weights on world production of the underlying commodities and 2) basing weights on the perceived relative worldwide importance of the commodity. The various indices use either arithmetic or geometric averaging to calculate component returns.

Professor’s Note: Although there are other characteristics an index must meet to be considered investable, the easiest way to look at it is whether an investor can actually hold the index by purchasing all the assets in the index in the same weights as in the index. For example, an investor can purchase and hold all the stocks of the S&P 500. If that cannot be done, the index is not investable.

- **Managed futures** have several investable benchmarks. Some common benchmarks, such as the Mount Lucas Management Index (MLMI), replicate the return to a mechanical, trend-following strategy. The strategies usually include utilizing both long and short positions using trading rules based upon changes in technical indicators. Other benchmarks, such as the CTA Indices published by the Center for International Securities and Derivatives Markets (CISDM), are indices based upon peer-group managed futures funds. They can use dollar-weighted (CTA$) or equal-weighted (CTAEQ) returns from databases of separately managed accounts. Among these indices there are benchmarks based upon the level of discretionary management and the underlying market, as well as trend-following or contrarian.

- **Distressed securities** funds are often considered a hedge fund subgroup. Most of the index providers for hedge funds have a sub-index for distressed securities. Benchmarks in this area have the same characteristics as long-only hedge fund benchmarks.

Figure 2 presents a summary of these alternative investment benchmarks, their construction, and their associated biases. Hedge fund benchmarks are then discussed separately.
Figure 2: Alternative Investment Benchmarks

<table>
<thead>
<tr>
<th>Benchmarks</th>
<th>Construction</th>
<th>Biases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real estate</td>
<td>NCREIF; NAREIT. NCREIF is value weighted; NAREIT is cap weighted.</td>
<td>Measured volatility is downward biased. The values are obtained periodically (annually).</td>
</tr>
<tr>
<td>Private equity</td>
<td>Provided by Cambridge Associates and Thomson Venture Economics.</td>
<td>Repricing occurs infrequently which results in dated values.</td>
</tr>
<tr>
<td>Commodities</td>
<td>Dow Jones-UBS Commodity Index; S&amp;P Commodity Index.</td>
<td>Indices vary widely with respect to purpose, composition, and method of weighting.</td>
</tr>
<tr>
<td>Managed futures</td>
<td>MLMI; CTA Indices. MLMI replicates the return to a trend-following strategy. CTA Indices use dollar-weighted or equal-weighted returns.</td>
<td>Requires special weighting scheme.</td>
</tr>
<tr>
<td>Distressed securities</td>
<td>Characteristics similar to long-only hedge fund benchmarks.</td>
<td>Weighting either equally weighted or based upon assets under management. Selection criteria can vary.</td>
</tr>
</tbody>
</table>

Hedge Fund Benchmarks

Hedge fund benchmarks vary a great deal in composition and even frequency of reporting. Also, there is no consensus as to what defines hedge fund strategies and this leads to many differences in the indices, as style classifications vary from company to company. The following points summarize the ways index providers compose their respective indices.

- **Selection criteria** can vary, and methods include assets under management, the length of the track record, and the restrictions imposed on new investment.
- **Style classification** also varies as to how they classify a fund by style and whether it is included in a given index.
- **Weighting schemes** are usually either equally weighted or based upon assets under management.
- **Rebalancing rules** must be defined for equally weighted indices, and the frequency can vary from monthly to annually.
- **Investability** often depends upon frequency of reporting (e.g., daily reporting allows for investability while monthly reporting tends not to). Some indices are not explicitly investable, but independent firms modify the index to produce an investable proxy.

Some indices explicitly report the funds they include in the composition of the index, and some do not. Some indices report monthly and some report daily. Examples of providers of *daily indices* are Hedge Fund Research (HFR), Dow Jones (DJ), and
Standard & Poor’s (S&P). The DJ and S&P explicitly list the funds included in their indices and use an equal-weighting approach.

The following lists providers of monthly indices with a few of their general characteristics:

- **CISDM of the University of Massachusetts**: several indices that cover both hedge funds and managed futures (equally weighted).
- **Credit Suisse/Tremont**: provides various benchmarks for different strategies and uses a weighting scheme based upon assets under management.
- **EACM Advisers**: provides the EACM100® Index, an equally weighted index of 100 funds that span many categories.
- **Hedge Fund Intelligence, Ltd.**: provides an equally weighted index of over 50 funds.
- **HedgeFund.net**: provides an equally weighted index that covers more than 30 strategies.

Hedge fund benchmark selection includes several issues:

- **Relevance of past data** may be questionable. If hedge funds are a reflection of manager skill, then past returns for indices is less relevant to future returns since hedge fund indices frequently change composition and thus managers within the index. The empirical evidence shows that funds within a particular style do have similar returns and that individual managers do not consistently beat their style group. The data also suggests volatility of past returns tends to persist even when return does not. This makes selection of the relevant comparison benchmark very important.

- **Popularity bias** can result if one of the funds in a value-weighted index increases in value and then attracts a great deal of capital. The inflow of investment to that fund will have a misleading effect on the index. Research has shown that indices can easily suffer from a popularity bias of a particular style, which is caused by inflows and not the actual return on investment. Even without the popularity bias, a dramatic increase in one style can bias an index. The problem with equally weighted indices is that they are not rebalanced often and effectively. This lowers their investability.

- **Survivorship bias** is a big problem for hedge fund indices. Indices may drop funds with poor track records or that fail, causing an upward bias in reported values. Studies have shown that the bias can be as high as 1.5–3% per year. The degree of survivorship bias varies among the hedge fund strategies. It is lower for event-driven strategies and higher for hedged equity strategies.

- **Stale price bias** varies depending on the markets used by the hedge fund. If the fund operates in markets with infrequent trading, the usual issues of appraisal or infrequent pricing and the resulting understatement of volatility can arise. The evidence suggests this is not a large problem.

- **Backfill or inclusion bias** is a similar problem but arises from filling in missing past data. It tends to be directionally biased, as only managers who benefit from the missing data have an incentive to supply the data. It seems to be an issue with some indices.
RETURN ENHANCEMENT AND DIVERSIFICATION

LOS 31.f: Evaluate the return enhancement and/or risk diversification effects of adding an alternative investment to a reference portfolio (for example, a portfolio invested solely in common equity and bonds).

Real Estate

Real estate is an asset class as well as an alternative investment. High risk-adjusted performance is possible because of the low liquidity, large lot sizes, immobility, high transactions costs, and low information transparency that usually means the seller knows more than the buyer.

Real estate typically reacts to macroeconomic changes differently than stocks and bonds, and each investment has a large idiosyncratic (unsystematic) risk component. Because of both of these characteristics, real estate has provided diversification. Using data for the period 1990–2004, Figure 3 compares the returns of the indicated portfolios based on benchmarks for the indicated asset classes.

Figure 3: Portfolio Returns From 1990–2004

<table>
<thead>
<tr>
<th>Measure (annualized)</th>
<th>50/50 Stock/Bonds</th>
<th>40/40/20 Stocks/Bonds/REITs</th>
<th>40/40/20 Stocks/Bonds/Unsmoothed NCREIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>9.60%</td>
<td>10.34%</td>
<td>9.33%</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>7.87%</td>
<td>7.62%</td>
<td>6.59%</td>
</tr>
<tr>
<td>Sharpe ratio</td>
<td>0.67</td>
<td>0.79</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Some conclusions from Figure 3 and past data include:

- Adding either direct real estate or REITs to a stock/bond portfolio significantly increases the portfolio Sharpe ratio.
- The Sharpe ratio using REITs is only slightly better than the Sharpe ratio using direct real estate even though REITs had a higher return for the period because direct real estate produces a better diversification effect.

Private Equity

Private equity is less of a diversifier and more a long-term return enhancer. Private equity investments (both venture capital and buyout funds) are usually illiquid, require a long-term commitment, and have a high level of risk with the potential for complete loss. In addition, there is often a minority discount associated with the investment. Because of these issues, investors require a high expected internal rate of return (IRR). Venture capital investments have lower transparency than buyout funds, which can actually add to the potential for large profits.
The difference in transparency between venture capital funds and buyout funds is caused by the different natures of the investments. Venture capital, for example, is provided to new, non-public companies in need of capital for growth. By definition, the managers of firms receiving the funds have considerably more information on the true value of the firm than the investing public. This adds to the risk faced by venture capital funds but, at the same time, increases the possible return to venture capitalists, who make it a point to learn as much about the firm as possible before investing. Buyout funds, on the other hand, usually provide capital to managements and others to purchase the equity of publicly traded firms.

Private equity returns typically move with stock market returns. Computed correlations are often positive and low, but some attribute the low correlation to the infrequently updated (i.e., “stale”) prices of the private equity. Each investment has a large idiosyncratic risk component, however, which can provide moderate diversification.

Because the primary benefit from private equity is return enhancement, Figure 4 gives the most important information for comparison. From the figure, we see that in the most recent years, venture capital funds and buyout funds had a lower return than both small-cap and large-cap stocks (NASDAQ and S&P). Over the long term of 20 years, however, private equity had higher returns.

**Figure 4: Returns to Private Equity and Equity Markets**

<table>
<thead>
<tr>
<th>Period</th>
<th>NASDAQ</th>
<th>S&amp;P 500</th>
<th>VC Funds</th>
<th>Buyout Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002–2005</td>
<td>22.4%</td>
<td>14.7%</td>
<td>4.9%</td>
<td>14.7%</td>
</tr>
<tr>
<td>2000–2005</td>
<td>–10.1%</td>
<td>–3.1%</td>
<td>–9.3%</td>
<td>3.1%</td>
</tr>
<tr>
<td>1995–2005</td>
<td>7.5%</td>
<td>7.7%</td>
<td>26.5%</td>
<td>8.7%</td>
</tr>
<tr>
<td>1985–2005</td>
<td>12.3%</td>
<td>11.2%</td>
<td>16.5%</td>
<td>13.3%</td>
</tr>
</tbody>
</table>

**Commodities**

Commodities chiefly offer diversification to a portfolio of stocks and bonds. Correlations of commodity indices with stocks and bonds have been low and even slightly negative. With the exception of the agricultural subgroups, commodity indices have a strong positive correlation with inflation. That is a benefit to the investor because they provide a hedge against inflation, while stocks and bonds are hurt by inflation.

The returns on commodities have generally been lower than stocks and bonds over the period 1990–2004, both on an absolute basis and a risk-adjusted basis. The energy subgroup of commodities has had the highest returns, and without it, the broad GSCI index return would have been much lower. Figure 5 gives the statistics for 1990–2004.
Commodities have had higher returns in more recent years. For the sub-period of 2000–2004, the GSCI average return of 13.77% was higher than both the −2.30% return for stocks and the 8.0% return on bonds. The high volatility of commodities, however, still gave it a lower Sharpe ratio than bonds (0.5 for commodities as compared to 1.11 for bonds).

We see how commodities play a useful role in the portfolio in Figure 6, which compares a 50/50 stock/bond portfolio to a portfolio with an allocation to commodities. The return is slightly lower, but the Sharpe ratio is higher.

Because commodities had a higher return in more recent years and stocks had a negative average return, commodities enhanced portfolio returns even more for the most recent years, as shown in Figure 7.

Hedge Funds

Hedge funds generated higher absolute and risk-adjusted returns than stocks and bonds over the period 1990–2004. The Hedge Fund Composite Index (HFCI) return, standard
deviation, and Sharpe ratio were 13.46%, 5.71%, and 1.61, respectively. Hedge funds ranked between bonds and stocks in the more recent period of 2000–2004, where the corresponding numbers were 6.84%, 4.83%, and 0.86. For the more recent period, the mean return and Sharpe ratio is higher than the measures for stocks, but they are both lower than the measures for bonds.

As was the case for most of the previous alternative investments, a 40/40/20 stock/bond/HFCI portfolio had a higher return and lower standard deviation than the 50/50 stock/bond portfolio over both the 1990–2004 and 2000–2004 periods.

Hedge funds vary widely, however, so the benefits of investing in one of any given style will differ. Figure 8 provides a representative list of the best and worst performing funds with their correlations with the S&P 500 and the Lehman Government/Corporate Bond Index. The last two rows in Figure 8 comment on each index’s return and how well it added diversification over the period 1990–2004.

### Figure 8: Hedge Fund Strategy Index Performance From 1990–2004

<table>
<thead>
<tr>
<th>Measure (annualized)</th>
<th>Short Selling</th>
<th>MSCI World</th>
<th>Fixed-Income Arbitrage</th>
<th>Equity Hedge</th>
<th>Global Macro</th>
<th>HFCI (composite)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>–0.61%</td>
<td>7.08%</td>
<td>7.62%</td>
<td>15.90%</td>
<td>16.98%</td>
<td>13.46%</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>19.39%</td>
<td>14.62%</td>
<td>3.61%</td>
<td>9.34%</td>
<td>8.38%</td>
<td>5.71%</td>
</tr>
<tr>
<td>Sharpe ratio</td>
<td>–0.25</td>
<td>0.19</td>
<td>0.92</td>
<td>1.24</td>
<td>1.51</td>
<td>1.61</td>
</tr>
<tr>
<td>Correlation w/ S&amp;P 500</td>
<td>–0.76</td>
<td>0.86</td>
<td>0.06</td>
<td>0.64</td>
<td>0.26</td>
<td>0.59</td>
</tr>
<tr>
<td>Correlation w/ bonds</td>
<td>–0.01</td>
<td>0.09</td>
<td>–0.06</td>
<td>0.10</td>
<td>0.34</td>
<td>0.17</td>
</tr>
<tr>
<td>Performance</td>
<td>Poor</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Diversification</td>
<td>Good</td>
<td>Poor</td>
<td>Good</td>
<td>Moderate</td>
<td>Good</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

#### Managed Futures

Managed futures are usually considered a category of hedge funds and are usually compared to stocks and bonds, but their record has been similar to that of hedge funds. Over the period 1990–2004, the dollar-weighted index of separately managed accounts (CTA$) had a return, standard deviation, and Sharpe ratio equal to 10.85%, 9.96%, and 0.66, respectively, which is about the same as stocks but with a better Sharpe ratio. They also had a higher return than bonds with a lower Sharpe ratio.

The CTA$ also ranked between bonds and stocks from 2000–2004. The corresponding numbers were 7.89%, 8.66%, and 0.60. The return was certainly higher than the –2.30% return for stocks and slightly less than the 8.0% return for bonds; however, the Sharpe ratio for bonds was higher at 1.11.
A portfolio consisting of 36/36/18/10 of stocks/bonds/HFCl/CTA$ accounts had a higher return and Sharpe ratio than a 40/40/20 stocks/bonds/HFCl portfolio for both the longer 1990–2004 and shorter 2000–2004 periods.

Note that actively managed separate accounts are those where the managers seek to take advantage of mispricing opportunities. There is evidence that short-term momentum and other strategies can produce excess returns. Managed futures seem to provide unique returns and diversification benefits. This is made evident from the near-zero correlation (~0.01) between the index of separately managed accounts and a 50/50 stock/bond fund.

**Distressed Securities**

Distressed security returns have had a relatively high average return but a large negative skew, so the comparisons using averages and Sharpe ratios can be misleading. They can provide high returns because many investors cannot hold distressed-debt securities, and few analysts cover the market. Based on comparisons of the average return and Sharpe ratio, the HFR Distressed Securities Index outperformed both stocks and bonds, both on an absolute and on a risk-adjusted basis. The returns are often event-driven, so they are uncorrelated with the overall stock market.

**For the Exam:** The diversification benefits of alternative investments are also discussed in Study Session 8, Asset Allocation. Be prepared to determine whether alternative investments are appropriate for a client’s portfolio considering the client’s objectives and constraints. For the exam, this is particularly relevant for a morning case where you need to allocate among several asset classes. Remember from Study Session 8 that there are drawbacks to adding alternative investments to a portfolio (e.g., amount of capital required, lack of liquidity) but there are also benefits (e.g., diversification, return enhancement).

**Real Estate Equity Investing**

**LOS 31.g:** Describe the advantages and disadvantages of direct equity investments in real estate.

Direct equity real estate investing has the following advantages and disadvantages.

**Advantages:**
- Many expenses are tax deductible.
- Ability to use more leverage than most other investments.
- Direct control of the properties.
- Ability to diversify geographically.
- Lower volatility of returns than stocks even after correcting for smoothing.
Disadvantages:

- Lack of divisibility means a single investment may be a large part of the investor's portfolio.
- High information costs.
- High commissions.
- High operating and maintenance costs plus hands-on management requirements.
- Special geographical risks, such as neighborhood deterioration.
- Political risks, such as changing tax codes.

**VENTURE CAPITAL INVESTING**

**LOS 31.h**: Discuss the major issuers and suppliers of venture capital, the stages through which private companies pass (seed stage through exit), the characteristic sources of financing at each stage, and the purpose of such financing.

In a typical sequence, the venture capitalist brings capital to start a company based on an attractive business plan and/or to fund and grow an existing private company. The typical exit plan involves an IPO (initial public offering) to sell stock to the public and pay off the early private investors. This can take years to execute.

There is an extensive vocabulary to describe venture capital. The issuers (companies seeking capital) of venture capital include formative-stage companies that are either new or young and expansion-stage companies that need funds to expand their revenues or prepare for an IPO.

The investors (suppliers) include:

- **Venture capitalists** are specialists who identify pools of capital available for investing in and find the promising private companies to invest in. They may pool investor's capital into venture capital funds or trusts.
- **Corporate venturing** refers to large companies that invest in venture capital opportunities in their own area of business expertise.
- **Angel investors** are considered to be knowledgeable, accredited individuals who are often the first outsiders (non-founders or relatives) who invest in the company.

The stages through which private companies pass are early stage, expansion stage, and exit stage. The early stage includes seed money often put up by the entrepreneur or other family members to begin prototype work, then start-up funds to begin product development and marketing, and first-stage funding to begin manufacturing and sales.

The expansion stage can include very young companies with an established product looking to expand sales, more established companies seeking to fund growth, or even companies soon to launch an IPO. Second-stage financing supports further expansion of production and sales, while third-stage financing can support additional major expansion. Mezzanine or bridge financing is used to prepare for an IPO and may include both debt and equity capital.
The exit stage could involve an IPO, merger with another company, or acquisition by another company (which might be a venture capital fund specializing in such activity).

**LOS 31.i: Compare venture capital funds and buyout funds.**

*CFA® Program Curriculum, Volume 5, page 38*

In contrast to venture capital funds, buyout funds usually have:

- A higher level of leverage.
- Earlier and steadier cash flows.
- Less error in the measurement of returns as more of the return is from cash flow return.
- Less frequent losses.
- Less upside potential.

These differences are the natural consequence of buyout funds purchasing entities in later stages of development or established companies and corporate spin-offs, where the risks are lower.

**Convertible Preferred Stock**

**LOS 31.j: Discuss the use of convertible preferred stock in direct venture capital investment.**

*CFA® Program Curriculum, Volume 5, page 32*

Convertible preferred stock is a good vehicle for direct venture capital investment because preferred stockholders must be paid a specified amount (e.g., twice their initial investment) before common stockholders can receive cash in the form of dividends or other distributions. Any buyout of the company that is favorable to shareholders will lead to the conversion of the preferred stock. Typically, investors in subsequent rounds of financing receive preferred stock with a claim that is senior to any previously issued preferred stock. Seniority is included to entice subsequent investors and makes those preferred shares more valuable than those issued earlier.

**Private Equity Investing**

**LOS 31.k: Explain the typical structure of a private equity fund, including the compensation to the fund’s sponsor (general partner) and typical timelines.**

*CFA® Program Curriculum, Volume 5, page 32*

Private equity funds usually take the form of limited partnerships or limited liability companies (LLCs). These legal structures limit the loss to investors to the initial investment and avoid corporate double taxation. For limited partnerships, the sponsor is called the general partner; for LLCs, the sponsor is called the managing director. The sponsor constructs and manages the fund and selects and advises the investments.
The timeline starts with the sponsor getting commitments from investors at the beginning of the fund and then giving “capital calls” over the first five years (typically). This is referred to as the commitment period. The expected life of these funds is seven to ten years, and there is often an option to extend the life up to five more years.

The sponsor can receive compensation in several ways. First, the sponsor has capital invested that earns a return. This is usually required, as it helps keep the sponsor’s interests in line with those of the limited partners. As a manager, the sponsor typically gets a management fee and incentive fee.

The management fee is usually 1.5% to 2.5% and is based upon the committed funds, not just funds already invested. The percent may decline over time based upon the assumption that the manager’s work declines over time.

The incentive fee is also called the carried interest. It is the share of the profits, usually around 20%, that is paid to the manager after the fund has returned the outside investors' capital—often after a minimum required return or hurdle rate has been paid on the cash from the outside investors. In some cases, the manager can receive early distributions based on expectations, but a claw-back provision may be in place that requires the manager to give back money if the expected profits are not realized.

Private Equity Investment Strategy

Any strategy for private equity investment must address the following issues:

- **Low liquidity**: the portfolio allocation to this class should typically be 5% or less with a plan to keep the money invested for seven to ten years.
- **Diversification through a number of positions**: because commitments are usually large, only investors with portfolios over $100 million can invest in the necessary five to ten investments needed for diversification. Diversified, commingled funds exist for smaller investors, but these funds have additional fees.
- **Diversification strategy**: knowing the unique aspects of a proposed private equity investment as they relate to the overall portfolio.
- **Plans for meeting capital calls**: committed funds are called as needed, and the investor needs to be prepared to meet the calls.
Commodity Investing

LOS 31.m: Compare indirect and direct commodity investment.

Direct commodity investment entails either purchasing the actual commodities or gaining exposure via derivatives. Indirect commodity investment is the purchase of indirect claims (e.g., shares in a corporation) that deal in the commodity.

Direct investment gives more exposure, but cash investment in commodities can incur carrying costs. Indirect investment may be more convenient, but it may provide very little exposure to the commodity, especially if the company is hedging the risk itself.

The increase in the number of investable indices in commodities and their associated futures is indicative of the advantages of investing via derivatives. These indices also make investing in commodities available to smaller investors.

The Term Structure of Futures Prices

LOS 31.n: Explain the three components of return for a commodity futures contract and the effect that an upward- or downward-sloping term structure of futures prices will have on roll yield.

The components of the return to a commodity futures contract are the spot return, the collateral return, and the roll return. These components are usually considered to be additive, so one component can be calculated given the value of the others:

\[
\text{total return} = \text{spot return} + \text{collateral return} + \text{roll return}
\]

Spot return or price return of the underlying commodity. For example, if corn prices rise 2% for the period, the spot return for the futures contract is 2%. Spot return can be positive or negative.

Collateral return is the periodic risk-free return. The implicit assumption is that cash equivalents equal to the full price of the contract position are held. For example, if corn contracts are held one month and the periodic risk-free rate is 0.3%, the collateral return is 0.3%. Collateral return will be positive.

Roll yield or return is the change in the futures contract price for the time period minus the change in the spot price of the commodity for the period. It can be positive or negative and is affected by the shape of the futures term structure. Backwardation is a downward-sloping term structure of futures prices (i.e., each successive futures price is lower). Such a condition predicts a positive roll return, as the futures price increases to converge with the spot price at the expiration of the contract. If the term structure is upward-sloping, called contango, the roll return would be negative.
Example: Calculating the roll return to a commodity futures contract

The change in price on a futures contract is $6, the spot return is $3, and the collateral return is $1. Calculate the roll return.

Answer:

\[ \text{roll return} = \text{change in futures price} - \text{spot return} = 6 - 3 = 3 \]

The collateral return is not part of the change in the futures price and is not included in the calculation for the roll return.

Commodities and Inflation

LOS 31.o: Describe the principle roles suggested for commodities in a portfolio and explain why some commodity classes may provide a better hedge against inflation than others.

Commodities generally provide a diversification benefit to traditional portfolios. Some commodities also provide specific diversification and protection against unexpected increases in inflation. Two factors affect whether a commodity is a good hedge against unexpected inflation: storability and demand relative to economic activity.

Whether a commodity is storable is the primary determinant in its value providing a hedge against unexpected inflation. For example, the values of storable commodities such as precious metals (e.g., gold, silver), industrial metals (e.g., zinc, aluminum, copper), and energy (e.g., crude oil, heating oil, natural gas) are positively related to unexpected changes in inflation. That is, they tend to increase (decrease) in value with unexpected increases (decreases) in inflation. They have provided good diversification against unexpected inflation.

Non-storable commodities like agricultural commodities (e.g., livestock, wheat, corn) have shown values that are negatively (positively) affected by unexpected increases (decreases) in inflation. They have not provided diversification against unexpected inflation.

Another factor to consider with respect to inflation hedging capability is whether the commodity’s demand is linked to economic activity. Those that enjoy a more or less constant demand regardless of the level of economic activity, for example, seem to provide little hedge against unexpected changes in inflation. Again, agricultural commodities tend to fall into this group. Those commodities that are most affected by the level of economic activity (e.g., energy, precious metals) tend to be better hedges.
HEDGE FUND CLASSIFICATIONS

LOS 31.p: Identify and explain the style classification of a hedge fund, given a description of its investment strategy.

CFA® Program Curriculum, Volume 5, page 57

Professor's Note: The following material relates to LOS 31.d and 31.p.

Hedge funds are classified in various ways by different sources. Because hedge funds are a “style-based” asset class, strategies can determine the subgroups. Within the strategies, there can be even more precise subgroups such as long/short and long-only strategies. The following is a list of nine of the more familiar hedge fund strategies.

1. Convertible arbitrage seeks to exploit mispricings or anomalies in the price of convertible securities such as convertible bonds, convertible preferred stock, or warrants. Both long and short positions are taken to hedge the risks. A common example is to buy undervalued convertible bonds and short the stock. The investor owns the convertible which includes a “call option” on the stock and shorts the stock which should leave the position hedged against changes in the stock price. Interest is earned from the bond coupons and from investing the proceeds of the short-sale. The strategy would benefit if stock volatility increases and the convertible rises in value. (The value of the embedded call option in the convertible should rise with increasing volatility.) If the yield curve is upward sloping, making the yield on the bond higher than short term borrowing rates, the strategy might also be leveraged to enhance returns.

2. Distressed securities are fundamentally different investments than conventional debt and equity investments. Many investors are not allowed to or do not want to deal with the legal complications for these securities. The resulting securities may be undervalued and offer superior returns. Distressed securities are generally illiquid, making it difficult or impossible to short the securities. These funds are generally long (not hedged) portfolios.

3. Emerging markets generally only permit long positions, and often there are no derivatives to hedge the investments.

4. Equity market neutral typically combines long and short positions in under-valued and over-valued securities (pairs trading) to eliminate systematic risk while capitalizing on mispricing.

5. Hedged equity strategies take long and short positions in under- and over-valued securities to exploit mispricings. Unlike market neutral funds, they do not seek to remove systematic risk. They might be net long, short, or hedged based on the manager’s view of the markets.
6. **Fixed-income arbitrage** involves taking long and short positions in fixed-income instruments based upon expected changes in the yield curve and/or credit spreads.

7. **Global macro strategies** take positions in major financial and non-financial markets through various means (e.g., derivatives and currencies). The distinguishing feature is that they tend to focus on an entire group or area of investment instead of individual securities or classes of securities.

8. **Merger arbitrage** or **deal arbitrage** focuses on returns from mergers, spin-offs, takeovers, and so on. For example, if Company X announces it will acquire Company Y, the manager might buy shares in Y and short X.

9. **Fund of funds (FOF)** describes a hedge fund that invests in many hedge funds. The idea is to get diversification among hedge fund managers or styles, but there is a fee paid to the manager of the fund of funds, as well as to the managers of the funds in the fund of funds.

Another classification scheme divides hedge funds strategies into five general segments:

1) **relative value**, 2) **event-driven**, 3) **hedged equity**, 4) **global asset allocators**, and 5) **short selling**.

1. **Relative value** strategies attempt to exploit price discrepancies. This category combines the equity market neutral, the convertible arbitrage, and fixed-income arbitrage strategies mentioned previously. As the name implies, this strategy compares the relative values of assets and attempts to capitalize, through various long and short strategies, on the relative mispricing.

2. **Event-driven** strategies invest with a short-term focus on an event like a merger (merger arbitrage) or the turnaround of a distressed company (distressed securities).

3. **Equity hedge** entails taking long and short equity positions with varying overall net long or short positions and can include leverage.

4. **Global asset allocators** take long and short positions in a variety of both financial and non-financial assets.

5. **Short selling** takes short-only positions in the expectation of a decline in value.

As a skill-based investment class, the risk and return of a hedge fund depends heavily upon the skill of the manager. We can make a distinction concerning risk, however, in that styles that are mainly long-only (e.g., distressed securities) tend to offer less potential for diversification than long/short styles, and liquidity can vary from fund to fund or even within subgroups.
HEDGE FUND STRUCTURE

LOS 31.q: **Discuss** the typical structure of a hedge fund, including the fee structure, and **explain** the rationale for high-water mark provisions.

The most common compensation structure of a hedge fund consists of an assets-under-management (AUM) fee of about 1% to 2% and an incentive fee of 20% of profits. The definition of profit should be spelled out in the terms of the investment. It could be the dollar return over the initial investment, for example, or the dollar return above the initial investment increased by some hurdle rate.

**High water marks** (HWMs) are typically employed to avoid incentive fee double-dipping. For example, assume a fund is valued and opened for subscription on a quarterly basis. Each quarter, the increase in value over the previous quarter is determined and investors pay incentive and management fees accordingly. This is fine, as long as the fund’s value is higher at each successive valuation. If the value of the fund is lower than the previous quarter, however, the manager receives only the management fee, and the previous high value of the fund (i.e., the last fund value at which incentive fees were paid) is established as a HWM. Investors are then required to pay incentive fees only if and when the value of the fund rises above the HWM. Note that HWMs are investor- and subscription-date specific. For those who subscribe while the fund value is below the previously established HWM, that HWM is not relevant. They will pay management fees each quarter, as well as incentive fees, for increases in value above the value at their subscription date.

A **lock-up period** is a common provision in hedge funds. Lock-up periods limit withdrawals by requiring a minimum investment period (e.g., one to three years) and designating exit windows. The rationale is to prevent sudden withdrawals that could force the manager to have to unwind positions.

Incentive fees are paid to encourage the manager to earn ever-higher profits. There is some controversy concerning incentive fees because the manager should have goals other than simply earning a gross return. For example, the manager may be providing limited downside risk and diversification. An incentive fee based upon returns does not reward this service.

Managers with good track records often demand higher incentive fees. The concern for investors is whether the manager with a good historical record can continue to perform well enough to truly earn the higher fees.
FUND OF FUNDS

LOS 31.r: Describe the purpose and characteristics of fund-of-funds hedge funds.

CFA® Program Curriculum, Volume 5, page 58

A fund of funds (FOF) is a hedge fund that consists of several, usually 10 to 30, hedge funds. The point is to achieve diversification, but the extra layer of management means an extra layer of fees. Often, an FOF offers more liquidity for the investor, but the cost is cash drag caused by the manager keeping extra cash to meet potential withdrawals by other investors. Despite the drawbacks, FOF are good entry-level investments.

An FOF may be a better indicator of aggregate hedge fund performance than the typical hedge fund index because it suffers from less survivorship and backfill bias. If an FOF includes a hedge fund that dissolves, it includes the effect of that failure in its return, while an index may simply drop the failed fund along with its historical performance.

An FOF can, however, suffer from style drift. This can produce problems because the investor may not know what she is getting. Over time, individual hedge fund managers may tilt their respective portfolios in different directions. Also, it is not uncommon for two FOF that claim to be of the same style to have returns with a very low correlation.

FOF returns have been more highly correlated with equity markets than those of individual hedge funds. This characteristic has important implications for their use as diversifiers in an equity portfolio.

HEDGE FUND PERFORMANCE EVALUATION

LOS 31.s: Critique the conventions and discuss the issues involved in hedge fund performance evaluation, including the use of hedge fund indices and the Sharpe ratio.

CFA® Program Curriculum, Volume 5, page 63

The hedge fund industry views hedge fund performance appraisal as a major concern with many special issues and conventions to address. One special issue is that some claim that hedge funds are absolute-return vehicles, which means that no direct benchmark exists. Instead, the fund targets some absolute return per period. That target return is not really a benchmark because it is not investable. The question (and problem) is how to determine alpha. The problem is especially perplexing given that most performance evaluation techniques are based on long-only positions and hedge funds use various combinations of long and short positions and leverage. To create comparable portfolios, analysts might 1) use a single- or multi-factor model or 2) create tracking portfolios that have comparable return and risk characteristics. In either case, the resulting customized benchmark is used for subsequent evaluation.
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Session 13

Cross-Reference to CFA Institute Assigned Reading #31 – Alternative Investments Portfolio Management

Conventions to consider in hedge fund performance evaluation are the impact of performance fees and lock-up periods, the age of funds, and the size of funds. Empirical studies have found that:

- Funds with longer lock-up periods tend to produce higher returns than those with shorter lock-up periods.
- Younger funds tend to outperform older funds.
- Large funds underperform small funds.

Returns. By convention, hedge funds report monthly returns by comparing the ending value of the fund to the beginning value \( \left( \frac{V_f}{V_0} - 1 \right) \). These simply-calculated monthly returns are then compounded to arrive at annual returns. Note that returns are often biased by entry into and exit from the fund, which are allowed on a quarterly or less frequent basis, and by the frequency of the manager’s trading (i.e., cash flows).

Professor’s Note: You will see in the GIPS® material in Study Session 18 that the way cash flows are handled affects the resulting return calculations.

To smooth out variability in hedge fund returns, investors often compute a rolling return, such as a 12-month moving average. A 12-month moving average is the average monthly return over the most recent 12 months, including the current month. The next moving average return is calculated by adding the next month and dropping the most distant month. In this fashion, the average return is always calculated using returns for 12 months.

Leverage. The convention for dealing with leverage is to treat an asset as if it were fully paid for (i.e., effectively “look through” the leverage). When derivatives are included, the same principle of deleveraging is applied.

Risk. Using standard deviation to measure the risk of a hedge fund can produce misleading results. For example, hedge fund returns are usually skewed with significant leptokurtosis (fat tails), so standard deviation fails to measure the true risk of the distribution (i.e., standard deviation does not accurately measure the probability of returns in the tails).

Downside deviation. Downside deviation measures only the dispersion of returns below some specified threshold return. The most common formula for downside deviation is:

\[
\text{downside deviation} = \sqrt{\frac{\sum_{i=1}^{n} \min(\text{return}_i - \text{threshold}, 0)^2}{n - 1}}
\]

The threshold return in the formula is usually either zero or the risk-free rate of return. If the threshold is a recent average return, then we call the downside deviation the semivariance. The point of these measures is to focus on the negative returns and not penalize a fund for high positive returns, which increases measured standard deviation.
Professor’s Note: It is fairly easy to visualize how earning a few very high returns in conjunction with average returns could produce a large standard deviation, even when the manager produced no negative returns. In this case, we should properly conclude that the manager performed well on a risk-adjusted basis, but using standard deviation to measure variability (i.e., risk) could lead us to conclude that the manager took unnecessary risk.

The Sharpe Ratio

Annual hedge fund Sharpe ratios are calculated using annualized measures, as discussed earlier:

\[ \text{Sharpe}_{HF} = \frac{\text{annualized return} - \text{annualized risk-free rate}}{\text{annualized standard deviation}} \]

In addition to concerns associated with the way returns are calculated, the Sharpe ratio has the following limitations with respect to hedge fund evaluation:

- **Time dependency:** The annual Sharpe ratio is typically estimated using shorter time periods. For example, to estimate the annual Sharpe ratio for a hedge fund using quarterly returns, the analyst multiplies the quarterly return by 4 and multiplies the quarterly standard deviation by the square root of 4. Thus, the annualized Sharpe ratio is biased upward by the square root of 4.
- **Assumes normality:** Measures that incorporate standard deviation are inappropriate for skewed return distributions.
- **Assumes liquidity:** Because of infrequent, missing, or assumed return observations, illiquid holdings have upward-biased Sharpe ratios (i.e., downward-biased standard deviations).
- **Assumes uncorrelated returns:** Returns correlated across time will artificially lower the standard deviation. For example, if returns are trending for a period of time, the measured standard deviation will be lower than what may occur in the future. Serially-correlated returns also result when the asset is illiquid and current prices are not available (e.g., private equity investments).
- **Stand-alone measure:** Does not automatically consider diversification effects.

In addition to these statistical shortcomings, the Sharpe ratio has been shown to have little power for predicting winners (i.e., it uses historical data). Also, research has found evidence that managers can manipulate their reported returns to artificially inflate their Sharpe ratio.

**Managed Futures**

LOS 31.t: Describe trading strategies of managed futures programs and the role of managed futures in a portfolio.

CFA® Program Curriculum, Volume 5, page 88

Managed futures programs are typically run by Commodity Pool Operators (CPOs). CPOs can themselves be commodity trading advisors (CTAs) or will hire CTAs to
actually manage all or part of the pool. In the United States, both must be registered with the U.S. Commodity Futures Trading Commission and the National Futures Association.

Managed futures (CTAs) are typically classified by style, the markets in which they specialize, or by strategy. Because they often seek performance in major markets, managed futures are sometimes thought of as a subset of global macro hedge funds that specialize in trading derivatives.

Professor’s Note: Some CTAs prefer not to work within the structure of a private or public pool (CPO).

CTA strategies can be described as systematic or discretionary. CTAs that specialize in systematic trading strategies typically apply sets of rules to trade according to short-, intermediate-, and/or long-term trends. They may also trade counter to trends in a contrarian (against the trend) strategy.

A discretionary trading strategy is much as it sounds. The strategy is based on the discretion of the CTA (commodity trading advisor), in the same way that any active manager seeks value.

Managed futures can also be classified according to the markets in which they trade. They apply systematic or discretionary trading strategies in financial markets, currency markets, or diversified markets.

In financial markets, they trade in financial (i.e., interest rate) and currency futures, options, and forward contracts. Those that specialize in currency markets trade exclusively in currency derivatives. A fund that trades in diversified markets trades in all the financial derivatives markets described as well as commodity derivatives.

Role in the Portfolio

The primary benefit to managed futures is the significant diversification potential (i.e., improved Sharpe ratios). For example, some research has even shown that managed futures have exhibited positive correlation to equities and bonds during up markets and negative correlations during falling markets, although the performance seems to be related to specific strategies and time periods. In particular, private funds seem to add value whereas publicly traded funds have performed poorly, both stand-alone and in portfolios.

In selecting a CTA to include in the portfolio, the manager should consider risk. For example, even though CTAs often exhibit negative correlations with equities, correlations among CTAs themselves can range anywhere from significantly positive (i.e., close to 1.0) to only modestly positive. In addition, the beta that relates the performance of an individual CTA to a fund of CTAs can be a good indicator of future risk-adjusted performance. Just as equity beta relates the volatility (risk) of an individual equity security or portfolio to the overall equity market, the CTA beta measures the risk of the individual CTA relative to a fund of CTAs.
Distressed Securities Investing

LOS 31.u: Describe strategies and risks associated with investing in distressed securities.

The major types of distressed securities investing strategies are long-only value investing, distressed debt arbitrage, and private equity.

Long-only value investing basically tries to find opportunities where the prospects will improve and, of course, tries to find them before other investors do. High-yield investing is buying publicly traded, below-investment grade debt. Orphan equities investing is the purchase of the equities of firms emerging from reorganization. The reason these present a market opportunity is that some investors cannot participate in this market and many do not wish to do the necessary due diligence.

Professor’s Note: An issue of debt that has fallen from investment grade to below-investment grade is referred to as a “fallen angel.”

Distressed debt arbitrage is the purchasing of a company’s distressed debt while short selling the company’s equity. The investment can earn a return in two ways: 1) if the firm’s condition declines, the debt and equity will both fall in value; the equity should decline more in value, though, because debt has seniority; and 2) if the company’s prospects improve, because of the priority of interest over dividends, the returns to bondholders should be greater than that of equity holders, including dividends paid on the short position. The possibility of returns from the two events provides a good market opportunity.

Private equity is an “active” approach where the investor acquires positions in the distressed company, and the investment gives some measure of control. The investor can then influence and assist the company as well as acquire more ownership in the process of any reorganization. By providing services and obtaining a strategic position, the investors create their own opportunities. Vulture funds, which specialize in purchasing undervalued distressed securities, engage in this type of strategy.
Concerns of Distressed Securities Investing

LOS 31.v: Explain event risk, market liquidity risk, market risk, and “J-factor risk” in relation to investing in distressed securities.

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Distressed securities can have event risk, market liquidity risk, market risk, J-factor risk, and other types of risk.

- **Event risk** refers to the fact that the return on a particular investment within this class typically depends on an event for the particular company. Because these events are usually unrelated to the economy, they can provide diversification benefits.

- **Market liquidity risk** refers to low liquidity and the fact that there can be cyclical supply and demand for these investments.

- **Market risk** from macroeconomic changes is usually less important than the first two types mentioned.

- **J-factor risk** refers to the role that courts and judges can play in the return, and this involves an unpredictable human element. By anticipating the bankruptcy court judge’s rulings (the J-factor), the distressed security investor knows whether to purchase the distressed company’s debt or equity.
KEY CONCEPTS

LOS 31.a
Common features of alternative investments include:
- Low liquidity.
- Good diversification potential.
- High due diligence costs.
- Difficult to value.
- Limited access to information.

Alternative investments can provide:
- Exposure to asset classes that stocks and bonds cannot provide.
- Exposure to special investment strategies (e.g., hedge and venture capital funds).
- Special strategies and unique asset classes (e.g., funds that invest in private equity and distressed securities).

LOS 31.b
- Assess the market opportunity offered. Are there exploitable inefficiencies in the market for the type of investments in which the manager specializes?
- Assess the investment process. Does the manager seem to have a competitive edge over others in that market?
- Assess the organization of the manager and its operations. Is it stable and well run? What has been the staff turnover?
- Assess the people by meeting with them and assessing their character.
- Assess the terms and structure (amount and time period) of the investment.
- Assess the service providers (i.e., lawyers, brokers, ancillary staff, etc.) by investigating the outside firms that support the manager’s business.
- Review documents such as the prospectus or private-placement memorandum and the audits.

LOS 31.c
- Taxes. Tax issues can be unique to the individual because the characteristics of private-wealth clients and their investments can vary greatly. For individuals, there can be partnerships, trusts, and other situations that make tax issues complex.
- Suitability. Time horizons and wealth of individuals can vary a great deal. With individuals, there is also the emotional aspect, like preferences for, or aversion to, certain types of assets.
- Communication. Communication with the client helps determine suitability of recommendations and the overall management process.
- Decision risk. Decision risk is the risk of irrationally changing a strategy. For example, the adviser must be prepared to deal with a client who wants to get out of a position that has just declined in value.
- Concentrated positions. Wealthy individuals’ portfolios frequently contain large positions in closely held companies. Such ownership should be considered with the overall allocation to alternative investments, like private equity.
LOS 31.d
Real estate can be broken down into direct and indirect investment. Examples of direct investment in real estate include ownership of residences, commercial real estate, or agricultural land, and it involves direct management of the assets. Indirect real estate investments include:

- Companies that develop and manage real estate.
- Real estate investment trusts (REITs).
- Commingled real estate funds (CREFs).
- Separately managed accounts.
- Infrastructure funds.

Private equity subgroups include start-up companies, middle-market private companies, and private investment in public entities. A direct investment in private equity is when the investor purchases a claim directly from the firm (e.g., preferred shares of stock). Indirect investment is usually done through private equity funds, which include venture capital (VC) and buyout funds.

Commodity investments can also be grouped into direct and indirect subgroups. Direct investment is either through the purchase of the physical commodity or the purchase of derivatives (e.g., futures) on those assets. Indirect investment in commodities is usually done through investment in companies whose principal business is associated with a commodity (e.g., investing in a metal via ownership of shares in a mining company). Many commodities have a low correlation with stocks and bonds and a positive correlation with inflation.

Managed futures funds share many characteristics with hedge funds. The primary feature that distinguishes managed futures from hedge funds is the difference in the assets they hold. Managed futures funds tend to trade only in derivatives markets, while hedge funds tend to trade in spot markets and use futures for hedging. Also, managed futures funds generally take positions based on indices, while hedge funds tend to focus more on individual asset price anomalies. In other words, hedge funds tend to have more of a micro focus, while managed futures tend to have a macro focus.

Buyout funds are the largest segment of the private equity market. Middle-market buyout funds concentrate on divisions spun off from larger, publicly traded corporations and private companies that, due to their relatively small size, cannot efficiently obtain capital. Mega-cap buyout funds concentrate on taking publicly traded firms private. In either case, the target represents an investment opportunity through the identification of under-valued assets, the ability to restructure the debt of the firm, and/or improved (i.e., more efficient) management and operations.

Infrastructure funds specialize in purchasing public infrastructure assets (e.g., airports, toll roads) from cities, states, and municipalities. Distressed securities are securities of companies that are in or near bankruptcy. As with managed futures, analysts often consider distressed securities to be part of the hedge fund class of alternative investments. It may also be part of the private equity class.
LOS 31.e

Real Estate: Benchmarks: NCREIF, NAREIT. Construction: NCREIF is value weighted, NAREIT is cap weighted. Biases: Measured volatility is downward biased. The values are obtained periodically (annually).


Managed Futures: Benchmarks: MLI, CTA Indices. Construction: MLI replicates the return to a trend-following strategy. CTA Indices use dollar-weighted or equal-weighted returns. Biases: Requires special weighting scheme.

Distressed Securities: Benchmarks: Characteristics similar to long-only hedge fund benchmarks. Construction: Weighting either equally weighted or based upon assets under management. Selection criteria can vary. Biases: Self-reporting, backfill or inclusion bias, popularity bias, and survivorship bias.

LOS 31.f

Over the long term, in most cases, a 20% investment in alternative investments would have improved both the absolute return and the risk-adjusted return of a stock/bond portfolio. Over the 1990–2004 time period, adding managed futures to a portfolio of stocks, bonds, and hedge funds increased the return and the Sharpe ratio. Private equity provided less diversification than the other classes but provided return enhancement. Distressed securities have been found to provide both diversification and return enhancement.

LOS 31.g

Advantages of direct equity real estate investing:
- Many expenses are tax deductible.
- Ability to use more leverage than most other investments.
- Provides more control than stock investing.
- Ability to diversify geographically.
- Lower volatility of returns than stocks.

Disadvantages of direct equity real estate investing:
- Lack of divisibility means a single investment may be a large part of the investor’s portfolio.
- High information cost, high commissions, high operating and maintenance costs, and hands-on management requirements.
- Special geographical risks, such as neighborhood deterioration and the political risk of changing tax codes.
LOS 31.h
Venture capital issuers include formative-stage companies and expansion-stage companies.

Venture capital buyers include angel investors, venture capitalists, and large companies (i.e., strategic partners).

A private company typically goes through the following stages.
• The early stage consists of three phases:
  ♦ Seed.
  ♦ Startup.
  ♦ First stage.
• The later stage occurs after revenue has started and funds are needed to expand sales.
• The exit stage is the time when the venture capitalist realizes the value of the investment. It can occur through a merger, an acquisition, or an IPO.

LOS 31.i
In contrast to venture capital funds, buyout funds usually have:
• A higher level of leverage.
• Earlier and steadier cash flows.
• Less error in the measurement of returns.
• Less frequent losses.
• Less upside potential.

These differences are the natural consequence of buyout funds purchasing entities in later stages of development or even established companies where the risks are lower.

LOS 31.j
Convertible preferred stock is a good vehicle for direct venture capital investment. This is because preferred stockholders must be paid a specified amount (e.g., twice their initial investment) before common stockholders can receive cash in the form of dividends or other distributions. Any buyout of the company that is favorable to shareholders will lead to the conversion of the preferred stock. Typically, investors in subsequent rounds of financing receive preferred stock with a claim that is senior to any previously issued preferred stock. Seniority is included to entice subsequent investors and make those preferred shares more valuable than those issued earlier.

LOS 31.k
Private equity funds usually take the form of limited partnerships or limited liability companies (LLCs). These legal structures limit the loss to investors to the initial investment and avoid corporate double taxation. For limited partnerships, the sponsor is called the general partner; for LLCs, the sponsor is called the managing director.

The time line starts with the sponsor getting commitments from investors at the beginning of the fund and then giving “capital calls” over the first five years (typically), which are referred to as the commitment period. The expected life of these funds is seven to ten years, and there is often an option to extend the life up to five more years.

The sponsor can receive compensation in several ways. First, the sponsor has capital invested that earns a return. This is usually required as it helps keep the sponsor’s interests in line with those of the limited partners. As a manager, the sponsor typically gets a management fee of around 2% and an incentive fee of about 20% of the profits.
LOS 31.1
Any strategy for private equity investment must address the following issues:
- Low liquidity: Portfolio allocation to this class should be 5% or less with a plan to keep the money invested for 7 to 10 years.
- Diversification through a number of positions: Only investors with portfolios over $100 million can invest in the 5 to 10 investments needed for diversification. Diversified commingled funds exist, but these funds have additional fees.
- Diversification strategy: Know how the proposed private equity investment relates to the overall portfolio.
- Plans for meeting capital calls: Committed funds are only called as needed, and the investor needs to be prepared to meet the calls.

LOS 31.m
Direct commodity investment entails either purchasing the actual commodities or gaining exposure via derivatives. Indirect commodity investment is the purchase of indirect claims (e.g., shares in a corporation) that deal in the commodity.

Direct investment gives more exposure, but cash investment in commodities can incur carrying costs. Indirect investment may be more convenient, but it may provide very little exposure to the commodity, especially if the company is hedging the risk itself.

The increase in the number of investable indices in commodities and their associated futures is indicative of the advantages of investing via derivatives. These indices also make investing in commodities available to smaller investors.

LOS 31.n
The components of the return to a commodity futures contract are the spot return, collateral return, and the roll return:

\[
\text{total return} = \text{spot return} + \text{collateral return} + \text{roll return}
\]

As the name implies, the spot return (i.e., price return) is the return on the futures caused by the change in the underlying commodity’s spot price. The collateral return (i.e., collateral yield) is assumed to be the risk-free rate.

If an investor is long a contract and invests the value of the futures in T-bills, he will be able to pay for the required purchase at the futures’ maturity. Such a fully-hedged (i.e., fully-collateralized) position should earn the risk-free rate.

Backwardation produces a downward-sloping term structure of futures prices (i.e., each successive futures price is lower). Such a condition predicts a positive roll return, as the futures prices increase to the spot prices. If the term structure is positive, which is a result of contango, the roll return is negative.
LOS 31.o
It appears that whether a commodity is *storable* is the primary determinant in its value providing a hedge against unexpected inflation. For example, the values of storable commodities such as precious metals, industrial metals, and energy are positively related to unexpected changes in inflation. That is, they tend to increase (decrease) in value with unexpected increases (decreases) in inflation.

Nonstorable commodities, on the other hand, tend to exhibit the opposite behavior. Agricultural commodities (e.g., livestock, wheat, corn) tend to fall into this category. Their values are negatively (positively) affected by unexpected increases (decreases) in inflation.

Another factor to consider with respect to inflation hedging capability is whether the commodity’s demand is linked to economic activity. Those that enjoy a more or less constant demand regardless of the level of economic activity, for example, seem to provide little hedge against unexpected changes in inflation.

LOS 31.p
Hedge funds are classified in various ways by different sources. Because hedge funds are a “style-based” asset class, strategies can determine the subgroups. The following is a list of nine of the more familiar hedge fund strategies.

1. Convertible arbitrage commonly involves buying undervalued convertible bonds, preferred stock, or warrants, while shorting the underlying stock to create a hedge.

2. Distressed securities investments can be made in both debt and equity; because the securities are already distressed, shorting can be difficult or impossible.

3. Emerging markets generally only permit long positions, and often there are no derivatives to hedge the investments.

4. Equity market neutral (pairs trading) combines long and short positions in under-valued and over-valued securities, respectively, to eliminate systematic risk while capitalizing on mispricing.

5. Fixed-income arbitrage involves taking long and short positions in fixed-income instruments based upon expected changes in the yield curve and/or credit spreads.

6. Fund of funds describes a hedge fund that invests in many hedge funds to get diversification; there is a fee paid to the manager of the fund of funds, as well as to the managers of the funds in the fund of funds.

7. Global macro strategies take positions in major financial and non-financial markets through various means (e.g., derivatives and currencies), focusing on an entire group or area of investment instead of individual securities.

8. Hedged equity strategies (i.e., equity long-short) represent the largest hedge fund classification in terms of assets under management. These strategies take long and short positions in under- and over-valued securities, respectively. Hedged equity strategies do not focus on balancing the positions to eliminate systematic risk and can range from net long to net short.
9. Merger arbitrage (i.e., deal arbitrage) focuses on returns from mergers, spin-offs, takeovers, and so on.

Another classification scheme divides hedge funds strategies into five general segments:
1) relative value, 2) event driven, 3) hedged equity, 4) global asset allocators, and 5) short selling.
1. Relative value strategies attempt to exploit price discrepancies through various long and short strategies and on the relative mispricing.
2. Event-driven strategies invest with a short-term focus on an event like a merger (merger arbitrage) or the turnaround of a distressed company (distressed securities).
3. Equity hedge entails taking long and short equity positions with varying overall net long or short positions and can include leverage.
4. Global asset allocators take long and short positions in a variety of both financial and non-financial assets.
5. Short selling takes short-only positions in the expectation of a decline in value.

LOS 31.q
The most common compensation structure of a hedge fund consists of an assets-under-management (AUM) fee of about 1% to 2% and an incentive fee of 20% of profits.

High water marks (HWMs) are typically employed to avoid incentive fee double-dipping. For example, each quarter the increase in value over the previous quarter is determined, and investors pay incentive and management fees accordingly. If the value of the fund is lower than the previous quarter, however, the manager receives only the management fee, and the previous high value of the fund is established as a HWM.

A lock-up period limits withdrawals by requiring a minimum investment period (e.g., one to three years), preventing sudden withdrawals that could force the manager to have to unwind positions.

Incentive fees are paid to encourage the manager to earn ever higher profits. There is some controversy concerning incentive fees because the manager should have goals other than simply earning a gross return.

LOS 31.r
A fund of funds (FOF) consists of approximately 10 to 30 hedge funds. The point is to achieve diversification, but the extra layer of management means an extra layer of fees. Often, an FOF offers more liquidity for the investor, but the cost is cash drag. Despite the drawbacks, FOF are good entry-level investments because the manager of the FOF exercises due diligence.

An FOF may serve as a better benchmark because it suffers from less survivorship bias.

An FOF can suffer from style drift. Often two FOF that are classified as having the same style have a low correlation of returns.
FOF returns have been more highly correlated with equity markets than those of individual hedge funds. This characteristic has important implications for their use as a diversifier in an equity portfolio (i.e., as correlation increases, diversification decreases).

LOS 31.s
One special issue is that some claim that hedge funds are absolute-return vehicles, which means that no direct benchmark exists. The question (and problem) is how to determine alpha. Conventions to consider in hedge fund performance evaluation are the impact of performance fees and lock-up periods, the age of funds, and the size of funds.
• Funds with longer lock-up periods tend to produce higher returns than those with shorter lock-up periods.
• Younger funds tend to outperform older funds.
• Large funds underperform small funds.

By convention, hedge funds report monthly returns by comparing the ending value of the fund to the beginning value. These simply-calculated monthly returns are then compounded to arrive at annual returns. The convention for dealing with leverage is to treat an asset as if it were fully paid for. When derivatives are included, the same principle of deleveraging is applied.

Using standard deviation to measure the risk of a hedge fund can produce misleading results. Hedge fund returns are usually skewed with significant leptokurtosis (fat tails), so standard deviation fails to measure the true risk of the distribution.

Downside deviation is a popular hedge fund risk measure, as it measures only the dispersion of returns below some specified threshold return. The most common formula for downside deviation is:

\[
\text{downside deviation} = \sqrt{\frac{\sum_{i=1}^{n} \min(\text{return}_i - \text{threshold}, 0)^2}{n-1}}
\]

The threshold return in the formula is usually either zero or the risk-free rate of return. Annual hedge fund Sharpe ratios are calculated using annualized measures as:

\[
\text{Sharpe}_{HF} = \frac{\text{annualized return} - \text{annualized risk-free rate}}{\text{annualized standard deviation}}
\]

The Sharpe ratio has the following limitations with respect to hedge fund evaluation:
• Time dependency. Annualized Sharpe ratios are biased upwards by a factor of the square of time.
• Assumes normality. Measures that incorporate standard deviation are inappropriate for skewed return distributions.
• Assumes liquidity. Illiquid holdings have upward-biased Sharpe ratios (i.e., downward-biased standard deviations).
• Assumes uncorrelated returns. Returns correlated across time will artificially lower the standard deviation.
• Stand-alone measure. Does not automatically consider diversification effects.
LOS 31.t
CTAs that specialize in systematic trading strategies typically apply sets of rules to trade according to or contrary to short-, intermediate-, and/or long-term trends. A discretionary CTA trading strategy generates returns on the managers’ trading expertise, much like any active portfolio manager. CTAs can also be classified according to whether they trade in financial markets, currency markets, or diversified markets.

The primary benefit to managed futures is superior risk-adjusted performance and diversification, although the performance seems to be related to specific strategies and time periods. Private funds seem to add value; publicly traded funds have performed poorly both stand-alone and in portfolios. Even though CTAs often exhibit negative correlations with equities, correlations among CTAs themselves can range from significantly to modestly positive. The CTA beta (relative to other CTAs) can be a good indicator of future risk-adjusted performance.

LOS 31.u
• Long-only value investing attempts to find opportunities where the prospects will improve tries to find them before other investors do. High-yield investing is buying publicly traded, below-investment grade debt. Orphan equities investing is the purchase of the equities of firms emerging from reorganization.
• Distressed debt arbitrage is the purchasing of a company’s distressed debt while short selling the company’s equity. The investment can earn a return in two ways:
  ◦ If the firm’s condition declines, the debt and equity will both fall in value, but equity should decline more in value.
  ◦ If the company’s prospects improve, the returns to bondholders should be greater than that of equity holders.
• Private equity is an “active” approach where the investor acquires positions in the distressed company, and the investment gives some measure of control. The investor can then influence the company as well as acquire more ownership in the process of any reorganization.

LOS 31.v
Distressed securities can have several types of risk:
• Event risk refers to the fact that the return on a particular investment within this class typically depends on an event for the particular company. Because these events are usually unrelated to the economy, they can provide diversification benefits.
• Market liquidity risk refers to low liquidity and the fact that there can be cyclical supply and demand for these investments.
• Market risk from macroeconomic changes is usually less important than the first two types mentioned.
• J-factor risk refers to the unpredictable nature of bankruptcy court judges’ rulings.
CONCEPT CHECKERS

1. All of the following are special issues for the private wealth client when investing in alternative investments except:
   A. tax issues.
   B. decision risk.
   C. return enhancement.

2. Which of the following represent private equity subgroups where the company invested in has not typically started generating revenues?
   A. Start-up companies only.
   B. Start-up companies and middle-market private companies only.
   C. Start-up companies, middle-market private companies, and private investment in public entities only.

3. The hedge fund structure and private equity fund structure are subgroups of which alternative investment class?
   A. Real estate.
   B. Commodities.
   C. Distressed debt.

4. The strategies of convertible arbitrage, emerging markets, equity market neutral, and fixed-income arbitrage are categories of which alternative investment class?
   A. Real estate.
   B. Hedge funds.
   C. Commodities.

5. For use in evaluating hedge funds, the Sharpe ratio may not be appropriate because the Sharpe ratio assumes the returns:
   A. are positive only.
   B. reflect diversification.
   C. are serially uncorrelated.

6. Based on historical data, when compared to a 50/50 stock/bond portfolio, a 40/40/20 portfolio of bonds, stocks, and which of the following had a higher Sharpe ratio?
   A. Real estate only.
   B. Commodities only.
   C. Both real estate and commodities.

7. When comparing the returns of various types of hedge funds to the returns on stocks and bonds for the period 1990–2004:
   A. none outperformed stocks and bonds by any measure.
   B. some outperformed stocks and bonds and some did not.
   C. all outperformed stocks and bonds on a risk-adjusted basis.
8. Compared to an indirect investment in real estate, a direct investment in real estate has which one of following advantages?
   A. Lower commissions.
   B. Lower information cost.
   C. Potential for more leverage.

9. The buyers of venture capital who are the first investors after the entrepreneur’s family and friends would most likely be:
   A. vultures.
   B. angel investors.
   C. corporate venture capitalists.

10. Purchasing of a company’s distressed debt while selling the company’s equity short is called:
    A. market neutral.
    B. preferred arbitrage.
    C. distressed debt arbitrage.
ANSWERS – CONCEPT CHECKERS

1. C Return enhancement is certainly not a special issue. All the other choices are issues of concern for the private wealth client but generally not issues for the institutional client.

2. A Start-up companies, middle-market private companies, and private investment in public entities represent three subgroups of private equity. Middle-market private companies typically have revenues, as do public entities. The start-up companies are usually in a pre-revenue phase.

3. C Investments in distressed debt can have either of these structures; that is why distressed debt is often considered as a subclass of other alternative investment asset classes.

4. B Hedge funds have many strategies that include the following: convertible arbitrage, distressed securities, emerging markets, equity market neutral, fixed-income arbitrage, fund of funds, global macro strategies, hedged equity strategies, and merger arbitrage.

5. C The Sharpe ratio is probably not applicable to hedge funds because it assumes the returns are normally distributed and not serially correlated. Another problem is that the Sharpe ratio is a stand-alone measure and does not consider the diversification that the hedge fund can add to a portfolio.

6. C As is the case with most of the classes of alternative investments, adding either real estate or commodities to a bond and stock portfolio would have increased the Sharpe ratio for the period 1990–2004.

7. B The performance of the various classes varied widely, from a Sharpe ratio of –0.25 for the short selling strategies to 1.51 on global macro strategies.

8. C Higher information costs, higher commissions, and political risk are disadvantages of direct investment in real estate. Direct investment allows more leverage, however.

9. B Angel investors are usually accredited investors and the first outside investors after the family and friends of the company founders.

10. C This is the definition of distressed debt arbitrage.
The following is a review of the Alternative Investments for Portfolio Management principles designed to address the learning outcome statements set forth by CFA Institute. This topic is also covered in:

**SWAPS**

**EXAM FOCUS**

While derivative strategies and usage are important topics for the Level III exam, this is an odd topic assignment. It is very short, has only one LOS, and includes a great deal of material marked as optional (not directly related to the LOS).

**COMMODITY SWAPS, USE, AND RISK**

**LOS 32:** Evaluate commodity hedging strategies that rely on swaps and describe their inherent risk exposures.

For the Exam: The LOS could be interpreted as requiring the calculation of the price and subsequent value of a commodity swap. That is covered here, and it also provides the basis to understand the risks in a commodity swap. The risks will be credit risk, the risk of changes in the underlying commodity price, and changes in interest rates. Understand the calculations covered and the risks created in varying situations.

**Commodity Swap Price**

Consider a company that needs 10,000 barrels of oil in one and two years and that wishes to hedge against price changes in oil. The company could buy 1- and 2-year contracts on oil at forward prices of $95 and $97, respectively. Alternatively, the company could enter a 2-year swap to receive oil. The swap price would be a single price for both settlement dates and a kind of present value average of the forward prices.

If the 1- and 2-year spot rates are 2.0% and 2.2%, the single swap price (SP) must have the same present value as the two forward prices.

\[
\frac{95}{1.02} + \frac{97}{1.022^2} = 186.01 = \frac{SP}{1.02} + \frac{SP}{1.022^2}
\]

\[
SP = 95.99
\]

Alternatively, the swap price can be expressed and solved as the sum of the present values of the forward prices divided by the sum of the present value factors used in the numerator. The present value factors at 1- and 2-year rates of 2% and 2.2% are just the reciprocals of 1.02 and 1.022² or 0.9804 and 0.9574 respectively. The present value factors could also be referred to as the present value of a dollar or yen or any other...
currency. They could also be called the price of a zero-coupon bond with a face value of one currency unit. In the following formula they are denoted as FDF for the forward discount factor corresponding to time period t.

For a commodity swap the swap price is:

\[
\text{swap price} = \frac{\sum_{t=1}^{T} (FDF_t \times \text{forward price of commodity}_t)}{\sum_{t=1}^{T} FDF_t}
\]

Resolving for the swap price we get:

\[
\left[\$95(0.9804) + \$97(0.9574)\right] / [0.9804 + 0.9574] = \$95.99
\]

A similar formula is used to price interest rate swaps:

\[
\text{swap rate} = \frac{\sum_{t=1}^{T} (FDF_t \times \text{forward rate}_t)}{\sum_{t=1}^{T} FDF_t}
\]

The difference between the commodity swap and the interest rate swap is that in an interest rate swap the underlying “commodity” is interest rates. Hence the interest rate swap’s value is exposed to the risk of changing interest rates while the commodity swap is at risk to both changes in interest rates and the commodity price.

**Commodity Swap Structure and Risks**

It is important to notice that the swap price is not a simple arithmetic average of forward prices because implicit in the swap structure is that a loan is being made or received on each settlement date. In our example, the swap price was $95.99 and not the simple average of $95 and $97 for $96. Suppose in our example the forward prices correctly reflect what happens to spot prices over time: in one year oil is $95, and the contract buyer paid the simple average of $96. The buyer overpays $1, effectively loaning $1 to the oil seller. Then in two years if spot oil is $97, the buyer underpays for oil at the contract price of $96, receiving back the overpayment of $1. An interest free loan is not rational, and by setting the contract price at 95.99, the oil buyer overpays $1, effectively loaning $0.02 to the oil seller. Then in two years if spot oil is $97, the buyer underpays for oil at the contract price of $96, receiving back the overpayment of $1. An interest free loan is not rational, and by setting the contract price at 95.99, the oil buyer overpays (lends) $0.99 and then underpays (receives back on the loan) $1.01. The $0.02 reflects interest on the loan. But the implicit loan created by using a single swap price on each settlement date creates interest rate risk. The $0.02 was proper interest compensation based on initial interest rates. If rates change there can be a winner and loser on the implicit loan.

The structure of the swap can significantly affect the amount and kind of risks. The company could enter into a prepaid swap by paying a counterparty $186.01 today and then receiving oil at the settlement dates in one and two years. However, this is excessively risky and creates unnecessary credit risk and interest rate risk for the company.
The company has paid up-front and is at risk if the counterparty does not deliver the oil. Also, a large sum has been advanced, effectively making a large fixed-rate loan.

The swaps market more typically uses physical or financial settlement on each exchange date for the swap. With physical settlement, the company will pay for and receive oil on each settlement date for the contracted delivery amount (notional amount) at the contracted price. With financial settlement, the company will settle in cash for any difference in the spot price of oil and the swap price on each settlement date. In both cases, the credit risk is reduced to the current value of the swap and is much smaller than the total present value paid at initiation of a prepaid swap. No large sum is advanced at initiation of the swap.

For both physical and financial swaps the initial value is zero. The swap is contracted at an average of forward prices. The initial value is zero, based on initial market conditions where neither the buyer nor the seller has any initial advantage. Our example also illustrates why the value of the swap will change immediately after initiation if either commodity prices or interest rates change because both affect the swap price.

**Risk Factors for a Swap Dealer**

Suppose the counterparty to our original swap is a swap dealer. The dealer is contracting to sell oil to our company at $95.99. The dealer could find a matched book swap with another counterparty to buy oil at (for example) $95.90. In this back-to-back set of transactions the dealer has two counterparty risks with credit exposure to both counterparties if they do not honor the swap’s terms, but is fully hedged against changes in the price of the commodity and interest rates. The dealer has contracted to receive oil at $95.90 and deliver oil at $95.99, earning a bid-asked spread on each exchange date of $0.09.

But suppose the dealer cannot find a willing counterparty at a reasonable price for the offsetting swap. The dealer can buy oil in the forward market for $95.00 in one year and $97.00 in two years. This hedges the dealer against changes in the price of oil, but the dealer is entering an implicit loan in the process. In one year, the dealer delivers oil at $95.99 versus paying $95.00 on the forward contract, the dealer pockets (borrows) $0.99. In two years the dealer again receives $95.99 on the swap and pays $97.00 on the forward contract, effectively paying back $1.01 on the loan, with $0.02 the interest. As interest rates change that interest charge may become attractive or unattractive.

The point is that the dealer who used forwards to hedge the swap has two credit risk exposures to two counterparties (or more if each forward has a different counterparty), a small amount of interest rate risk from the implicit loan, and is hedged against a change in price of the commodity. If the dealer uses back-to-back swaps the dealer only has two counterparty risks.
Valuing Swaps

To summarize:

- The initial value of a physical or financial swap is zero because it is a present value reflection of forward prices. It is a fair price that both counterparties will willingly enter with no initial exchange of funds.
- The swap value will change as interest rates and underlying commodity prices change.
- Even if interest rates and commodity prices do not change, value of the swap will change as settlements occur and one or the other counterparty is making or receiving an implicit loan due to the single swap price used versus the varying forward prices for different settlement dates.
- The value of a commodity swap on any date can be computed as the present value of the settlement cash flows that can be locked in by taking offsetting positions in a new swap whose price reflects new forward contract prices.

For example, suppose in 3 months a new oil swap settling in 9 and 21 months (dates that match the settlement dates for our original 2-year swap, which are now in 9 and 21 months) is priced at $97 versus our original swap’s price of $95.99. The company that entered the original swap to pay $95.99 could enter this new swap to receive $97. The company now has back-to-back swaps and has locked in the receipt of $1.01 in 9 and 21 months. If 9- and 21-month annual interest rates are 3.0% and 3.5%, respectively, the value of the initial swap is now:

\[
\frac{1.01}{1.03^{0.75}} + \frac{1.01}{1.035^{1.75}} = 1.9388 \text{ per barrel of oil}
\]

Abusing Swaps, Enron

After the collapse of Enron in 2001, it subsequently became apparent it had used swap like transactions to create and hide large borrowing activity. Enron entered into the equivalent of prepaid swaps and received the present value of the forward prices. Enron then hedged the physical commodity exposure and contracted to make payments in the future. Exposure to the underlying commodity was hedged but Enron constructively borrowed large sums. Further confusing the real nature of the activity was the involvement of a supposed “third party” in the transactions, but in reality the third party was controlled by the bank with which Enron was contracting. The results were the nature of the transactions was hidden, the debt was not disclosed, and “profits” from use of the loans were reported as operating activities (not financial related activities). Investors were not able to judge the true riskiness of Enron until after its failure.
Swap Pricing in Seasonal Markets

Professor’s Note: The next section after this Professor’s Note is pretty far removed from the LOS. In the CFA text it receives just over one page of discussion with no end of chapter questions. Formulas are shown but never used and no math is illustrated. We are intentionally restricting our discussion to the concept. If you wish to look at the formulas they are available in the CFA text.

It is certainly plausible that an oil buyer might have a greater need for oil in certain seasons of the year. For example, the buyer may want the swap to specify larger quantities delivered in the winter and smaller quantities delivered in the summer. The basic commodity swap pricing approach can be modified for varying quantity by settlement date. Recall the single swap price is a present value average of forward prices. For a varying quantity swap, the forward prices would be the present value weighted by the varying quantity. For example, the winter price might be multiplied by 50 barrels and the summer price by 30 barrels.

The varying quantity swap could also allow for different prices on different delivery dates. First, the single swap price for a varying quantity swap would be found as discussed in the preceding paragraph. The summer and winter prices must be a present value weighted average of this number. Second, the desired summer (or winter) price is then arbitrarily selected, and then the winter (or summer) price is solved for such that the weighted present value of the two prices is the same as the weighted present value for the single price swap.
KEY CONCEPTS

LOS 32
The prepaid swap buyer pays the present value of forward prices upfront and has
(1) substantial credit risk that the other counterparty will not deliver the commodity,
(2) financial or interest rate risk because a large amount has been advanced at swap
initiation, and (3) the market price risk as spot and forward prices change in such a way
that the prepaid price was too high or too low.

For financially and physically settled swaps there is still market price risk from the
changes in price of the underlying commodity. But interest rate and credit risk are
considerably less as no upfront payment is made. At inception, the credit risk to both
parties is zero. The credit risk can go back and forth between the counterparties during
the life of the swap as the value of the swap changes.

A swap dealer who hedges a swap with a back-to-back swap has two swaps and two
counterparty (potential credit) risks but is hedged for market and interest rate risk. The
dealer who hedges using forwards also has two credit risk exposures and some interest
rate risk due to the implicit loans made or received, but is hedged for market price risk.

Swaps can be priced with varying seasonal quantity and/or price by including a varying
quantity and/or price component into the swap agreement.
CONCEPT CHECKERS

1. At inception, the value of a commodity swap is typically:
   A. zero.
   B. less than zero.
   C. greater than zero.

2. With respect to swap rates for interest rate swaps and swap prices for commodity swaps, which are weighted averages based upon forward contracts?
   A. Swap rates only.
   B. Swap prices only.
   C. Both swap rates and swap prices.

3. A change in interest rates and forward rates will affect the value of:
   A. commodity swaps only.
   B. interest rate swaps only.
   C. both interest rate swaps and commodity swaps.

4. Being able to vary the notional principal of a commodity swap in a swap contract is:
   A. both possible and legal.
   B. not possible but would probably be legal.
   C. not possible and would be illegal if possible.

Use the following information for Questions 5 and 6.

Concerned with global supply issues, a supply manager wants to hedge future purchases of crude oil that his firm will use in manufacturing solvents estimated to be 1,200,000 barrels in each year. Current forward prices for delivery of crude in one and two years are $125.88 and $129.01, respectively. The current 1-year and 2-year Treasury rates are 2.38% and 2.63%, respectively. The manager approaches a swap dealer to enter (strike) a 2-year swap agreement.

5. Based on current forward prices and interest rates, the fixed price for a 2-year crude oil swap is closest to:
   A. 125.44.
   B. 127.42.
   C. 128.22.

6. If at the first settlement date in one year the spot price of crude is $127.96, what would the most likely settlement action be? The manager will:
   A. make a payment of $312,000.
   B. receive a payment of $550,000.
   C. receive a payment of $648,000.
1. A The swap price is designed to make the value of the swap zero at inception.

2. C Both swap rates and swap prices are weighted averages based upon forward discount factors, or equivalently, zero-coupon bond prices.

3. C Because the value of both types of swaps is the present value of a locked-in set of cash flows, the value of both types of swaps is sensitive to changes in interest rates.

4. A Swap counterparties can design the swap any way they choose. Commodity swaps can have the quantity and swap price change over the life of the swap.

5. B The swap fixed price is the present value of the forward prices using the 1- and 2-year interest rates:

\[
\text{swap price} = \frac{125.88}{1.0238} + \frac{129.01}{(1.0263)^2} = 127.42
\]

6. C The manager will purchase the oil in the spot market, and because the spot price is above the swap fixed price, the manager will receive a payment from the dealer. If the spot price had instead been below the swap fixed price, the manager would have to make a payment to the dealer.

Professor’s Note: The final amount paid for the commodity should be the swap fixed price, so I recommend checking that if you are asked for this on the exam.

 settlement payment = (spot price – swap fixed price) NP

\[
= \left( \frac{$127.96/\text{barrel}}{} - \frac{$127.42/\text{barrel}}{} \right) \times 1,200,000 \text{ barrels} = $648,000
\]

Check:

Purchase 1.2 million barrels in the spot market:

$127.96 \times 1,200,000 = $153,552,000

Receive swap settlement of $648,000:

net per barrel = \frac{153,552,000 - 648,000}{1,200,000} = $127.42
The following is a review of the Alternative Investments for Portfolio Management principles designed to address the learning outcome statements set forth by CFA Institute. This topic is also covered in:

**COMMODITY FORWARDS AND FUTURES**

**EXAM FOCUS**

There are two important and related comments found in the introductory CFA material to this section that are overlooked by many candidates. They are important to what you will and will not find in this material. First, “each commodity forward … has some unique economic characteristics.” Second, “it would take an entire book to cover commodities in depth.” The explicit goal of this section is to cover the logic of the factors that may or may not apply to a given commodity. It will not “tie it up” in one comprehensive conclusion. Consistent with the LOS, focus on the concepts and implications of lease rates, storage costs, and convenience yields. Be able to make a direct calculation of a forward price and convenience yield.

**PRICING COMMODITY FORWARDS AND FUTURES**

LOS 33.a: Discuss pricing factors for commodity forwards and futures, including storability, storage costs, production and demand, and explain their influence on lease rates and the forward curve.

Commodity and financial forward contracts are similar in some regards. For example, the prices of both are logically based upon expected spot prices. Some financial forwards (e.g., S&P 500 Index) are based upon the expected future spot price minus dividends received during the holding period. The price of a commodity forward must also be based upon expectations, but there are several factors to consider.

• Some commodities, like metals, are easily storable allowing the cash-and-carry no-arbitrage mode studied at Level II to be applied. Other commodities like perishable foods are not storable which will restrict the application of cash-and-carry.
• Unlike stocks and bonds, there are significant storage costs to holding and safeguarding commodities.
• Some commodities have distinct seasonal or other production (supply) or demand patterns (for example, corn, electricity, and oil) that affect future spot and current forward prices.
• Some commodities are also appropriate for leasing.

Where applicable, the forward price of a commodity must reflect these factors.
Lease Rates

An investor without a current need for the commodity could buy it and lend it out to others who do have a current need. The borrower of the commodity would compensate the commodity lender with a payment. Because the commodity buyer has funds invested in the commodity, he must charge a lease rate. Failing to do so would amount to an interest-free loan of the money tied up in the commodity.

A lease rate, \( \delta \), is the amount of interest a lender of a commodity requires. The lease rate is defined as the return an investor requires to buy and then lend a commodity. From the borrower’s perspective, the lease rate represents the cost of borrowing the commodity. Unlike a dividend, the lease rate is not directly observable. The commodity does not declare a lease rate. In addition, all holders of a stock earn the dividend but the lease rate of a commodity can only be earned if the commodity owner chooses to lend it out. Financially, the lease rate functions just like a dividend and is modeled like a dividend in order to price commodity forwards. Both the lease rate and risk-free rate are important inputs to determining a commodity forward price.

A no-arbitrage price can be calculated using the approach taught at Level II with the lease rate substituting for the dividend yield. Given the annual lease rate, risk-free rate, spot price of the commodity, and term of the forward, the no-arbitrage forward price will be:

\[
F_{0,T} = S_0 e^{(R_F - \delta_l)T}
\]

where:
- \( S_0 \) = commodity current spot price
- \( R_F - \delta_l \) = risk-free rate less the lease rate
- \( T \) = the term is the fraction of a year to contract expiration

Example: Effect of lease rate

An investor wants exposure to a commodity. The investor could buy and hold the physical commodity or buy forwards. Assume there is an active lease rate for the commodity, all factors are correctly reflected in spot and forward prices, and the investor would not find it practical to lease the commodity. How should the investor add commodity exposure to the portfolio?

Answer:

Buy the commodity forward. Because the relative prices reflect leasing and the investor cannot earn the lease rate, buying the commodity would be overpaying because there is an expected return component the investor will not earn. All other factors are correctly reflected in the difference between the spot and forward prices.
Example: Pricing a commodity forward with a lease payment

Calculate the 12-month forward price for a bushel of corn that has a spot price of $5 and an annual lease rate of 7%. The appropriate continuously compounding annual risk-free rate for the commodity is equivalent to 9%.

Answer:

We can determine the 12-month forward price as follows:

$$ F_{0,T} = (S_0)e^{(R_F-h)T} = 5 \times e^{(0.09-0.07)(1)} = 5.101 $$

Because the lease rate is not directly observable, it is more common to rearrange the forward pricing formula to infer the lease rate from observed market prices. The annualized implied lease rate is:

$$ R = R_F - \frac{1}{T} \ln \left( \frac{F_{0,T}}{S_0} \right) $$

Example: Solving for the lease rate.

Calculate the annualized lease for the previous example if the forward price is $5.101:

Answer:

We can determine the 12-month lease rate as:

$$ \text{Lease rate} = 0.09 - \frac{1}{1} \ln \left( \frac{5.101}{5} \right) = 0.09 - \ln 1.2020 = 0.09 - 0.02 = 0.07 = 7.0\% $$

The Shape of the Forward Curve and the Lease Rate

If there are no other factors to consider:

- The forward market will be in contango (an upward sloping price curve with longer maturity contracts priced above shorter maturity contracts which are priced above the spot price) when the lease rate is less than the risk-free rate.
- The forward market will be in backwardation (a downward sloping price curve with longer maturity contracts priced below shorter maturity contracts which are priced below the spot price) when the lease rate is greater than the risk-free rate.

Professor’s Note: This is a simple consequence of the arbitrage based forward pricing formula. A lease rate (or dividend) on the underlying increases the relative value of owning the underlying spot asset and reduces the forward price, while the risk-free rate increases the financing cost to buy the underlying and makes the relative value of the spot asset less and raises the forward price.
Storage Costs

The same arbitrage based forward pricing formula can also incorporate storage costs, which are treated mathematically like the risk-free financing rate. Unlike stocks and bonds which have essentially zero storage costs, holding physical commodities will require a physical location to store the commodities and insure them against loss. The arbitrageur who buys the spot commodity and sells it at the forward price is conducting a _cash-and-carry_ because he pays cash but must store (i.e., carry) the commodity until the delivery date. The owner will only store the commodity if the forward price is greater than or equal to the expected spot price plus storage costs. This is represented mathematically as:

\[ F_{0,T} \geq S_0 e^{R_T} + \lambda(0, T) \]

where:

\[ \lambda(0, T) = \text{future value of storage costs from time 0 to } T \]

If storage costs are paid continuously and are proportional to the value of the commodity, then the no-arbitrage forward price becomes:

\[ F_{0,T} \geq S_0 e^{(R_T + \lambda)T} \]

where:

\[ \lambda = \text{continuous annual storage cost proportional to the value of the commodity} \]

**Example: Commodity forward pricing with storage costs and effective interest**

Calculate the 3-month forward price for a bushel of soybeans if the current spot price is $3/bushel, the effective monthly interest rate is 1%, and the monthly storage costs are $0.04/bushel.

**Answer:**

First, calculate the future value (at time \( T \)) of storage for three months, \( \lambda(0, T) \), as follows:

\[ \$0.04 + \$0.04(1.01) + \$0.04(1.01)^2 = \$0.1212 \]

The amount $0.1212 represents three months’ storage costs plus interest. Next, add the cost of storage to the spot price plus interest on the spot price:

\[ F_{0,T} = S_0 e^{R_T} + \lambda(0, T) \approx \$3.00(1.01)^2 + \$0.1212 = \$3.0909 + \$0.1212 = \$3.2121 \]
Example: Commodity forward pricing with storage costs and continuously compounded interest

Now assume that storage costs are paid continuously and are stated as a percent of the cost of the commodity. Calculate the 3-month forward price for a bushel of soybeans if the current spot price is $3/bushel, the continuously compounded annual interest rate is 12%, and the continuously compounding annual storage costs proportional to the value of the commodity is $0.48/bushel or 16%.

Answer:

The 3-month forward price is:

$$F_{0,T} = S_0 e^{(R_f + \lambda)T} = 3 e^{(0.12+0.16)(3/12)} = 3 e^{0.07} = 3.218$$

Convenience Yield

If the owners of the commodity need the commodity for their business, holding physical inventory of the commodity creates value. For example, assume a manufacturer requires a specific commodity as a raw material. In order to reduce the risk of running out of inventory and slowing down production, excess inventory is held by the manufacturer. This reduces the risk of idle machines and workers. A convenience yield is a non-monetary benefit associated with holding the commodity and can only be earned by those with an underlying business reason to hold the commodity. While it functions like a non-monetary dividend, it has an asymmetric impact on the no-arbitrage forward price:

- An arbitrageur who wishes to borrow the underlying commodity and sell it for a reverse cash-and-carry must compensate the lender of the commodity for lost convenience yield. Inserting the convenience yield in the no-arbitrage pricing formula generates a minimum forward price.
- An arbitrageur who wishes to buy the underlying commodity for a cash-and-carry has no convenience yield to factor in. Ignoring the convenience yield creates a maximum forward price.
For the Exam: The CFA text is quite specific that it will not provide a final comprehensive solution to all commodity pricing issues. Instead, the intent is to illustrate some of the complexities of commodity contract pricing. In relation to convenience yield it includes a footnote that not all market participants define it the same way. Regarding the lease rate, the CFA text makes two points:

- Prior to considering the convenience yield, the lease rate is defined as the negative of the storage costs.
- After considering the convenience yield, the lease rate is defined as the convenience yield minus storage costs.

Both statements are true, it is a matter of whether or not it is relevant to consider convenience yield.

Here is a handy guide for relating relative forward and spot commodity prices:

- Higher risk-free rates are a benefit of owning the forward as financing costs to hold the underlying commodity are avoided. In the pricing formula, \( R_f \) pushes up the relative price of the forward versus the spot price.
- Higher storage costs are a benefit of owning the forward as storage costs to hold the underlying commodity are avoided. In the pricing formula, \( \lambda \) pushes up the relative price of the forward versus the spot price.
- Higher lease rates are a cost of owning the forward as they are a lost opportunity that can only be earned by someone who owns the underlying commodity. In the pricing formula, \( -\delta \) reduces the relative price of the forward versus the spot price.
- Higher convenience yields are a cost of owning the forward as they are a lost opportunity that can only be earned by someone who has a business reason to own the underlying commodity. In the pricing formula, \( -c \) reduces the relative price of the forward versus the spot price. It is a factor in reverse cash-and-carry but not in cash-and-carry which results in a no-arbitrage range, rather than a single no-arbitrage price.

Of course, there can be combinations of costs and benefits where a calculation is required:

\[
F_{0,T} = S_0 e^{(R_f + \lambda - c)T}
\]

where:
\( \lambda \) = the storage costs
\( c \) = the convenience yield

And

\[
F_{0,T} = S_0 e^{(R_f - \delta)T}
\]

where:
\( \delta \) = lease rate

**Professor’s Note:** The lease rate (\( \delta \)) compensates the lender for the loss of the convenience yield less storage costs, so \( \delta = c - \lambda \).
COMMERCIAL CHARACTERISTICS

Certain commodities exhibit unique properties that impact their forward prices. For example, gold, corn, natural gas, and oil are all examples of commodities with characteristics that differ with respect to storage costs, the ability to store, production costs, and seasonal supply and demand. These differences are reflected in lease rates, storage costs, and convenience yields that influence the commodity forward prices and the shape of the forward curves. The next sections illustrate how various combinations of these and other factors may affect particular commodity markets.

Gold Forward Price Factors

Because gold can earn a return by lending it out, strategies for holding synthetic gold offer a higher return than holding just the physical gold without lending it out. When a positive lease rate is present, the synthetic gold is preferred to physically holding the gold because the lease rate represents the cost of holding the gold without having to lend it physically. In other words, by holding physical gold you sacrifice the lease rate and you incur storage costs.

The value of gold is also influenced by the costs of production. The present value of gold received in the future is simply the present value of the forward price computed at the risk-free rate of return. The total present value of gold production (i.e., the value of the gold mine) is calculated as:

\[
\text{total PV of production} = \sum_{i=1}^{n} X_i \left( F_{0,i} - c_{p,i} \right) e^{-\left(R_{F,i}\right)i},
\]

where:
- \( X_i \) = ounces of gold extracted (produced) in period \( i \)
- \( F_{0,i} \) = forward price today for delivery of one ounce at the end of period \( i \)
- \( c_{p,i} \) = production costs per ounce in period \( i \)
- \( R_{F,i} \) = risk-free rate over period \( i \)

Under this framework, the gold mine is assumed to operate the entire time and production is known with certainty.

Professor’s Note: Nothing in the LOS suggest you should memorize specific calculations shown in the various commodity markets. These are to illustrate how varying factors come into play for particular commodities. Gold is presented here only to show how production costs affect values. Note that the costs associated with mining gold are incorporated into the forward price, much like a storage cost.

Corn Forward Price Factors

Corn is an example of a commodity with seasonal production and a constant demand. Corn is produced in the fall of every year, but it is consumed throughout the year. In
order to meet consumption needs, corn must be stored. Thus, interest and storage costs need to be considered. The price of the corn will fall as it is being harvested and then rise to reflect the cost of storage until it is harvested again. Thus, the forward curve increases until harvest time, then drops sharply at harvest time and slopes upward again when the harvest is over.

Example: Corn commodity pricing with storage costs

Suppose the spot price today for a bushel of corn is $2.25, the continuously compounded interest rate is 5.5%, and the storage cost is 2.0% per month. Calculate the 6-month forward price.

Answer:

\[
F_{0.5} = 2.25 \times e^{(0.00458 + 0.02)6} = 2.25 \times 1.15893 = 2.61
\]

Professor’s Note: The 0.458% used for the monthly interest rate is the annual rate divided by 12.

Natural Gas Forward Price Factors

Natural gas is an example of a commodity with constant production but seasonal demand. Natural gas is expensive to store, and demand in the United States peaks during the winter months. In addition, the price of natural gas is different for various regions due to high international transportation costs. Storage is at its highest in the fall, just prior to the peak demand. Therefore, the forward curve rises steadily in the fall. The following example demonstrates how storage costs produce a positively sloped forward curve.

Example: Calculation of natural gas forward price with storage costs

Calculate the implied storage cost for natural gas for the month of October, if the October 2009 spot price is 4.071, the annual risk-free rate of interest is 6%, and the November forward price is 4.157.

Answer:

\[
4.157 = 4.071e^{0.005} + \lambda_{Oct2009}
\]

\[
4.157 = 4.091 + \lambda_{Oct2009}
\]

\[
4.157 - 4.091 = \lambda_{Oct2009}
\]

\[
0.066 = \lambda_{Oct2009}
\]
Oil Forward Price Factors

The physical characteristics of oil make it easier than natural gas to transport; consequently, the price of oil is comparable worldwide. Lower transportation costs and more constant worldwide demand cause the long-run forward price to be fairly stable. In the short run, supply and demand shocks cause more volatile prices because supply is fixed. For example, the Organization of Petroleum Exporting Countries (OPEC) may decrease supply to increase prices by causing a shortage in the short run. Supply and demand adjust to price changes in the long run.

COMMODITY ARBITRAGE

LOS 33.b: Identify and explain how to exploit arbitrage situations that result from the convenience yield of a commodity and from commodity spreads across related commodities.

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Convenience Yield

A convenience yield cannot be earned by the average investor who does not have a business reason for holding the commodity. The forward price, including a convenience yield and storage costs, is calculated:

\[ F_{0,T} \geq S_0 e^{(R_f + \lambda - c)T} \]

where:
\[ c = \text{convenience yield} \]
\[ \lambda = \text{storage costs} \]

The commodity borrower (i.e., lessee) is willing to pay \( \delta = c - \lambda \), which is the value of the convenience yield less the cost of storage. The value of the forward to the commodity borrower is calculated as follows:

\[ F_{0,T} \geq S_0 e^{(R_f - \delta)T} \]

For the investor who does not earn the convenience yield, cash-and-carry arbitrage implies that:

\[ F_{0,T} \leq S_0 e^{(R_f + \lambda)T} \]
Example: Impact of convenience yield on the no-arbitrage commodity forward pricing range

Suppose the owner of a commodity decides to lend it, and the commodity has a continuously compounded convenience yield of $c$. What range of prices must represent the no-arbitrage forward price?

Answer:

The owner of a commodity is able to create a range of no-arbitrage prices as follows:

$$ S_0 e^{(R_F + \lambda - c)T} \leq F_{0,T} \leq S_0 e^{(R_F + \lambda)T} \]

The upper bound $\left(S_0 e^{(R_F + \lambda)T}\right)$ depends on storage costs but not on the convenience yield. The lower bound $\left(S_0 e^{(R_F + \lambda - c)T}\right)$ adjusts for the convenience yield and therefore explains why forward prices may appear lower at times, when a convenience yield is considered.

Arbitrage and Commodity Spreads

A commodity spread results from a commodity that is an input in the production process of other commodities. For example, soybeans are used in the production of soybean meal and soybean oil. A trader creates a crush spread by holding a long (short) position in soybeans and a short (long) position in soybean meal and soybean oil.

Similarly, oil can be refined to produce different types of petroleum products such as heating oil, kerosene, or gasoline. This process is known as cracking and, thus, the difference in prices of crude oil, heating oil, and gasoline is known as a crack spread. For example, seven gallons of crude oil may be used to produce four gallons of gasoline and three gallons of heating oil. Commodity traders refer to the crack spread as 7-4-3, reflecting the seven gallons of crude oil, four gallons of gasoline, and three gallons of heating oil. Thus, an oil refiner could lock in the price of the crude oil input and the finished good outputs by an appropriate crack spread reflecting the refining process. However, this is not a perfect hedge because there are other outputs that can be produced (such as jet fuel and kerosene).

Example: Pricing a crack (i.e., crude oil) spread

Suppose we plan on buying crude oil in one month to produce gasoline and heating oil for sale in two months. The 1-month futures price for crude oil is currently $118/barrel. The 2-month futures prices for gasoline and heating oil are $125/barrel and $133/barrel, respectively. Calculate the 5-3-2 crack (commodity) spread.
Answer:
The 5-3-2 spread tells us the amount of profit that can be locked in by buying five barrels of oil and producing three barrels of gasoline and two barrels of heating oil.

\[
\text{Profit for a 5-3-2 spread} = (3 \times 125) + (2 \times 133) - (5 \times 118) = 375 + 266 - 590 = 51 \text{ for 5 barrels or } \frac{51}{5 \text{ barrels}} = 10.20/\text{barrel.}
\]

Professor’s Note: There is no calculation for interest adjustment in this example.

HEDGING AND BASIS RISK

LOS 33.c: Compare the basis risk of commodity futures with that of financial futures.

A perfect hedge rarely exists. A hedge can be perfect only if the item hedged and the hedging vehicle match exactly and the hedge is held to contract expiration. For example, a stock trades at $21 today and can be sold today in the forward market at $22 to settle in 6 months. If the stock is owned, sold forward, and delivered in 6 months, the hedge is perfect and the hedge locks in $22, the forward price. The initial basis was the initial forward price minus the spot price of $1.00. A perfect hedge will lock in:

- The initial forward price.
- The initial spot price plus basis.

When the hedge is imperfect, the results can be imperfect. The hedge might be lifted early if the term of the contract is longer than the desired term of the hedge, if the term of the contract is shorter than desired the contract might be rolled over into a new longer contract when the first contract comes due, or the contract may be based on something similar to but not the same as the item being hedged. In these cases the hedge may not achieve the initial forward price. In other words, the initial basis (difference between the forward and spot price) may change in unexpected ways, called basis risk.

This issue exists for both commodity and financial futures (and forwards) but it tends to be greater in commodities. The complicating issues for commodity hedging include:

- Hedging an uncertain quantity. A producer of coal might sell estimated production forward but actual production and date of production could easily differ from what was expected and hedged, resulting in an imperfect hedge and basis risk.
- Commodities are heterogeneous, not homogeneous. A user of natural gas in Florida might purchase gas contracts to hedge the need for gas. However, the available contract specifies the price of gas in Louisiana, a different physical location. The prices in the two locations can differ and fluctuate in relation to each other due to the difficulty and cost of transporting gas between the two locations. In this example, there is basis and cross-hedge risk.
• Cross-hedging is common. An airline needing to hedge the price of jet fuel may find it more practical to purchase oil futures as a hedge. While oil and jet fuel prices are related, they can move in unexpected ways in any given time period. There is basis and cross-hedge risk.

• Contracts often trade in useable volume only for near-term expiration dates. Suppose a gold user needs the same quantity of gold every month for two years. The lowest risk solution is a strip hedge. The user would buy gold futures contracts coinciding with each date that gold is needed. However, trading volume may be insufficient to allow purchase on the longer dates. The user may have to use a stack hedge of shorter dated contracts instead of the longer dates. A stack hedge requires buying more of the shorter contracts than of the number of longer contracts that would have been needed. As the shorter contracts come due, they will be rolled over to the needed (and now closer) dates. The stack hedge is premised on the changes in present value in the larger number of shorter contracts being sufficient to fund the rollover purchases that will have to be made at the current market price. This results in basis risk.

Professor’s Note: By now you should realize the exam process sometimes requires you to deal with issues without having seen or gone through all the underlying details and reading the material in context. Both of these issues are at work here. First, the mechanics of strip and stack hedges are not covered in the material, only that stack hedges may be necessary due to a lack of liquidity for longer dated contracts; this creates some residual risk when the contracts are rolled over.

Second, the terms basis and cross-hedge risk are used many times in the CFA material and they are often used interchangeably. A cross-hedge is most correctly used to refer to a difference in the hedged item and the hedge vehicle (for example, hedging jet fuel with oil). Basis risk is the risk that the difference between the forward and spot prices change in unexpected ways. Both risks can be related. On the exam and in some readings, the two are used interchangeably. When you answer questions on the exam be as precise and technically correct as possible, but read exam questions and material in the context of what was written to infer what was meant. You may feel this is unfair, but it is part of the testing process.
**KEY CONCEPTS**

**LOS 33.a**
The lease rate is defined as the amount of return the investor requires to buy and then lend a commodity. If an active lease market exists for a commodity, a commodity lender can earn the lease rate by buying a commodity and immediately selling it forward. The commodity market is in contango with an upward-sloping forward curve when the lease rate is less than the risk-free rate. The market is in backwardation with a downward-sloping forward curve when the lease rate is greater than the risk-free rate.

A commodity owner will only store the commodity if the forward price is greater than or equal to the spot price plus the future storage costs as follows: $F_{0,T} \geq S_0e^{R_fT} + \lambda(0,T)$, where $\lambda(0,T)$ represents the future value of storage costs for one unit of the commodity from time 0 to T. If storage costs are paid continuously and are proportional to the value of the commodity, the no-arbitrage forward price becomes $F_{0,T} = S_0e^{(R_f+\lambda)T}$.

Holding an excess physical inventory of the commodity creates non-monetary value for commodity owners who require the commodity as a production input. This is referred to as convenience yield, and the forward price including a convenience yield is calculated as $F_{0,T} \geq S_0e^{(R_f+\lambda-c)T}$, where $c$ is the continuously compounded convenience yield, proportional to the value of the commodity.

Gold, corn, natural gas, and oil are all examples of commodities with characteristics that differ with respect to storage costs, the ability to store, production costs, and seasonal demand. These unique differences influence the commodity forward prices and the shape of the forward curves.

**LOS 33.b**
A commodity used in production has a convenience yield that would be earned by a user of the commodity with a business reason to hold the commodity. The result is a no arbitrage range for the forward price:

$$S_0e^{(R_f+\lambda-c)T} \leq F_{0,T} \leq S_0e^{(R_f+\lambda)T}$$

The upper bound $S_0e^{(R_f+\lambda)T}$ depends on storage costs but not the convenience yield.

The lower bound $S_0e^{(R_f+\lambda-c)T}$ adjusts for the convenience yield and, therefore, explains why forward prices may appear lower at times when a convenience yield is considered.

**LOS 33.c**
Basis is the difference between the spot price (or rate) and the price (or rate) of the futures contract used to hedge. If the values of both move together perfectly, an investor long or short the asset can lock in a return or value by selling or buying futures, respectively. Any time the values of the spot and futures contracts do not move together perfectly, however, the hedger faces basis risk (i.e., an uncertain basis). As with financial futures, every commodity futures contract specifies a delivery amount and a delivery date. In addition, however, every commodity futures contract specifies a delivery location and the deliverable grade (i.e., quality).
Study Session 13
Cross-Reference to CFA Institute Assigned Reading #33 – Commodity Forwards and Futures

CONCEPT CHECKERS

1. The spot price for a commodity is $24. The annual lease rate is 6% for the commodity. The appropriate continuously compounding annual risk-free rate for the commodity is equivalent to 7%. The 6-month commodity forward rate is closest to:
   A. $23.91.
   B. $24.00.
   C. $24.12.

2. The current spot price for corn is $3/bushel, the effective monthly interest rate is 1.5%, and the monthly storage costs are $0.03/bushel. The 3-month forward price for a bushel of corn is closest to:
   A. $3.18.
   B. $3.23.
   C. $3.29.

3. Suppose that storage costs are paid continuously and are proportional to the cost of the commodity. Calculate the 3-month forward price for a bushel of corn if the current spot price is $2.50/bushel, the continuously compounded annual interest rate is 10%, and the continuously compounding annual storage costs proportional to the value of the commodity are 14.4%. The 3-month forward price is closest to:
   A. $2.55.
   B. $2.66.
   C. $2.73.

4. Suppose the owner of a commodity decides to lend out the commodity. If the commodity has a continuously compounded convenience yield of $c$, proportional to the value of the commodity, which of the following best represents the lowest forward price?
   A. $S_0e^{(R_f+\lambda)T}$.
   B. $S_0e^{(R_f-h-c)T}$.
   C. $S_0e^{(R_f+\lambda-c)T}$.

5. Suppose we plan on buying crude oil in one month to produce gasoline and heating oil for sale in two months. The 1-month futures price for crude oil is currently $120/barrel. The 2-month futures prices for gasoline and heating oil are $127/barrel and $135/barrel, respectively. What is the 7-5-2 crack (commodity) spread?
   A. $9.29/barrel.
   B. $12.71/barrel.
   C. $14.50/barrel.

6. Which of the following is not an example of basis risk? Purchasing:
   A. a Eurodollar contract, due to lack of commodity futures.
   B. an oil contract with delivery in a different geographical region.
   C. a commodity with a desired distant delivery with long-term contracts.
7. Which of the following commodities is an example of seasonal production and constant demand?
A. Gold.
B. Corn.
C. Natural gas.
ANSWERS – CONCEPT CHECKERS

1. C The 6-month forward rate is calculated as follows:
   \[ F_{0,T} = S_0 e^{(R_f - \delta)T} = 24 \times e^{(0.07 - 0.06)0.5} = 24.12 \]

2. B First, calculate the future cost of storage for three months, \( \lambda(0, T) \), as follows:
   \[ \$0.03 + \$0.03(1.015) + \$0.03(1.015)^2 = \$0.0914 \]
   The amount of \$0.0914 represents the 3-month storage costs plus interest. Next, add the cost of storage to the spot price plus interest.
   \[ F_{0,T} = S_0 e^{R_f T} + \lambda(0, T) \approx \$3.00(1.015^3) + \$0.0914 = \$3.1370 + \$0.0914 = \$3.23 \]

3. B The 3-month forward price is:
   \[ F_{0,T} = S_0 e^{(R_f + \lambda)T} = 2.50 e^{(0.10 + 0.144)/12} = 2.50(1.0629) = 2.657 \]

4. C The owner of a commodity is able to create a range of no-arbitrage prices as follows:
   \[ S_0 e^{(R_f + \lambda - \delta)T} \leq F_{0,T} \leq S_0 e^{(R_f + \lambda)T} \]
   The lower bound adjusts for the convenience yield and, therefore, explains why forward prices may appear lower at times when the convenience yield is considered. The upper bound depends on storage costs but not on the convenience yield.

5. A The 7-5-2 spread tells us the amount of profit that can be locked in by buying seven barrels of oil and producing five barrels of gasoline and two barrels of heating oil.
   \[ \text{Profit for a 7-5-2 spread} = (5 \times \$127) + (2 \times \$135) - (7 \times \$120) = \$635 + \$270 - \$840 = \$65 \text{ for 7 barrels, or } \$65 / 7 \text{ barrels} = \$9.29 / \text{barrel}. \]

6. C Basis risk results from the inability of commodities to create a perfect hedge. Differences due to timing, grade, storage costs, or transportation costs create basis risk.

7. B Corn is an example of a commodity with seasonal production and a constant demand. Corn is produced in the fall of every year, but it is consumed throughout the year.