# Chapter 1:

# Chapter 2:

# Chapter 3:

# Chapter 4: Statistical Foundations

## Demonstrate knowledge of the characteristics of return distributions.

* Recognize ex ante and ex post return distributions
* Recognize the importance of the normal distribution in statistical analysis
* Describe the characteristics of lognormal distributions

## Demonstrate knowledge of moments of return distributions (i.e., mean, variance, skewness, and kurtosis).

* Explain the first four raw moments of return distributions
* Explain the central moments of return distributions
* Explain skewness of return distributions
* Explain kurtosis and excess kurtosis of return distributions
* Describe the characteristics of platykurtic, mesokurtic, and leptokurtic distributions

Mesokurtic: same distribution with normal distribution

Leptokurti: positive excess kurtosis

Platykurtic: negative excess kurtosis

## Demonstrate knowledge of various measures of correlation of returns.

* Recognize the importance of correlation in alternative investment portfolio management

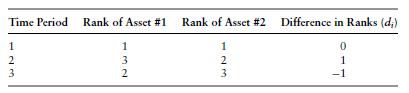
Correlation affects diversification, and the diversification drives the risk of a portfolio of assets relative to the risks of the portfolio’s constituent assets

* Define and calculate covariance
* Define and calculate correlation coefficient

It measures the degree of association between two variables

* Define and calculate the Spearman rank correlation coefficient

The spearman rank correlation is a correlation designed to adjust for outliers by measuring the relationship between variable ranks rather than variable values.





It is preferred because of the way it handles the effects of outliers (extremely high or low data values)

* Discuss the role of correlation in portfolio diversification

The reduction in risk is found by combining assets that are not perfectly positively correlated. The greatest risk reduction occurs when the assets’ correlation coefficient is -1. Ultimate diversification comes with no volatility

* Define and calculate beta in the context of the CAPM

Beta of an asset is defined as the covariance between the asset’s returns and a return such as the market index, divided by the variance of the index’s return

Beta indicates the responsiveness of asset I to fluctuations in the values of the market portfolio, or responsiveness of asset I to fluctuations in the benchmark.

* Define and calculate autocorrelation

Autocorrelation of a time series of returns from an investment refers to the possible correlation of returns with one another through time. For example, positive first-order autocorrelation is above average, return in t-1 tends to be followed by an above-average return in time t

First-order autocorrelation coefficient =

Note: autocorrelation would be zero in a perfectly efficient market

**Good**: how do we know that log returns will be roughly normally distributed over reasonably long periods of time if the returns have no autocorrelation and if very return on any asset over a long time period such as a month is the sum of the log returns of the sub-periods. Even if the returns over extremely small units of time are not normally distributed, the central limit theorem indicates that the returns formed over longer periods of time by summing the independent returns of the sub-periods will tend toward being normally distributed.

* Define and apply the Durbin-Watson test

Searching for the presence of first-order autocorrelation in time series

DW value of 2 means no significant autocorrelation

DW >>2 (e.g. DW>3): negative autocorrelation

DW <<2 (e.g. DW<1): positive autocorrelation

## Demonstrate knowledge of standard deviation (volatility) and variance.

* Define and explain return standard deviation (volatility)

Standard deviation is the typical amount by which an investment’s actual return deviates from its average

* Describe the properties of return variance and standard deviation and do calculation

The variance of return of a portfolio p

For perfectly correlated assets, the standard deviation of the portfolio p is

The variance of weekly return is the sum of variances of daily returns

when

The standard deviation of the levered position can be approximated using unlevered asset

For example, , then

For multiple period standard deviation,

when

when

## Demonstrate knowledge of methods used to test for normality of distributions.

* Recognize the three main reasons for non-normality observed in alternative investment returns (i.e., autocorrelation, illiquidity, and nonlinearity), and discuss the effect of each on returns

There are 3 main reasons for non-normality in alternative investment returns: autocorrelation, illiquidity, and nonlinearity. The impact of each on returns is listed below:

**Autocorrelation**: highly dispersed longer-term returns

**Illiquidity**: In illiquid markets, prices are often estimated by models and professional judgement rather than by competitive market prices. As a result, returns are smoothed and tend to exhibit less volatility

**Non**-**linearity**: highly non-symmetric return distribution over long time intervals.

* Discuss tests for normality that use sample moments

By testing skewness and kurtosis

* Recognize and apply the Jarque-Bera test

JB test involves a statistic that is a function of skewness and excess kurtosis

JG

where is the # observations, is the skewness of the sample, and is the excess kurtosis

the null hypothesis is: underlying distribution is **normal** and JB is equal to **zero**. Thus the JB test for normality is whether the test statistic is large enough to reject the null hypothesis of normality. The JB test is more powerful when the #observation is large.

For example, JB=2.219. Statistical confidence of 95%. The critical value is 5.99 >2.219, as such we cannot reject the null hypothesis of normality

## Demonstrate knowledge of time-series return volatility models.

* Identify various measures used in time-series models (e.g., price levels, price variation, risk)

GARCH: generalized autoregressive conditional heteroskedasticity

* Define the concepts of heteroskedasticity and homoscedasticity

Heteroskedasticity: variance of variable changes with respect to a variable, such as time

Homoscedasticity: variance of a variable is constant.

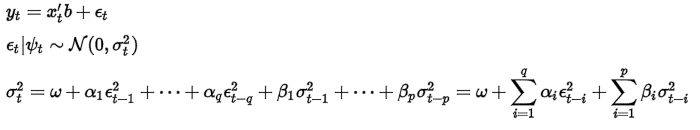
* Recognize the key components of the generalized autoregressive conditional heteroskedasticity (GARCH) method

GARCH method allows for heteroskedasticity and can be used when it is believed that risk is changing over time.

Unconditionally heteroskedastic: a financial asset exhibits a clear pattern of return variation

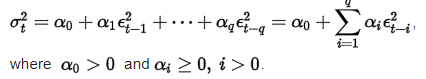
Conditionally heteroskedastic: different levels of return variation

* Describe how the GARCH method is used to model risk evolution through time



* Contrast the GARCH method with the autoregressive conditional heteroskedasticity (ARCH) method

ARCH allows future variances to rely only on past disturbances, whereas GARCH allows future variances to depend on past variances as well.



# Chapter 5

## Demonstrate knowledge of measures of financial risk

### Define and calculate semi-variance and semi-standard deviation

Semi-variance only considers the negative deviations and includes only the observations with values below the mean. it provides a sense of how much variability exists among losses, or among lower-than-expected outcomes. It is expressed as

Semi-deviation is the square root of semi-variance.

### Describe shortfall risk, target semi-variance, and target semi-standard deviation

Shortfall risk is simply the probability that the return will be less than the investor’s target rate of return

Target semi-variance substitutes the investor’s target rate o return in place of the mean return

Target semi-standard deviation (TSSD) is simply the square root of the target semi-variance

### Define and calculate tracking error

Tracking error indicates the dispersion of returns of an investment relative to a benchmark return, where a benchmark return is the contemporaneous realized return on an index or peer group of comparable risk.

where \bar{R} is the mean of R\_t - R\_{Bench,t}, which is often assumed to be zero

### Describe and calculate drawdown

Drawdown is defined as the maximum loss in the value of an asset over a specified time interval and is usually expressed in percentage-return form rather than currency (i.e. absolute amount). For example, for an asset $100, and falling to $60 would be said to have suffered a drawdown of 40%.

Maximum drawdown is defined the largest decline over any time interval within the entire observation period.

### Define and interpret VaR, and discuss its strengths and weaknesses as a risk measure

Value at risk (VaR) is the loss figure associated with a particular percentile of a cumulative loss function. In other words, VaR the maximum loss over a specified time period within a specified probability. It involves two parts

1. Length of time involved in measuring the potential loss

2. Probability used to specify the confidence that the given loss figure will not be exceeded

**Good**: the VaR summarizes potential loss in a condensed and easy-to-understand way to facilitate understanding and comparison.

**Bad**: as a single measure of potential loss, the information that it can contain is limited unless the user knows the shape of the distribution of the potential losses.

### Define and interpret conditional value-at-risk (CVaR)

Conditional value-at-risk (CVaR), aka expected tail loss, is the expected loss of the investor given that the VaR has been equaled or exceeded. the CVaR provides the investor with information about the potential magnitude of losses beyond the VaR.

## Demonstrate knowledge of methods for estimating value at risk (VaR)

### Apply a parametric approach to estimate VaR with normally distributed returns or with normally distributed underlying factors

If the potential losses being analyzed follow a normal distribution, a parametric approach can be used. Parametric VaR: a VaR computation assuming normality and using the statistics of the normal distribution.

Parametric VaR

where N is the number of standard deviation, which depends on the confidence level specified; is the estimated daily standard deviation;

99% confidence interval is 2.33

When volatility is modeled as a function of multiple underlying economic variables or factors, such as option price is modeled by a function of 5 variables. In this case, VaR is expressed using the volatilities and correlations of the underlying factors, as well as the sensitivity of the security prices to those factors.

### Describe methods for estimating volatility as an input for VaR calculations

Two primary approaches for estimating the volatility for VaR

1. As historical standard deviation of returns, including ARCH, GARCH

2. Based on market prices of options. These estimates, if available, are typically more accurate than estimates based on past data, since they reflect expectations of the future.

### Describe methods for estimating VaR for leptokurtic positions

1. Use a probability distribution that allows for fatter tails, such as t-distribution, which has a parameter that can be adjusted to alter the tail fatness.

2. To simply increase the number of standard deviations in the formula. The increase should be based on (historical) analysis of the extent of kurtosis

### Describe methods for estimating VaR directly from historical data

To view a large collection of previous price changes and compute the size of price change for which the specified percentage of outcomes was lower. For example, to get ETF price change for past 5000 days to form 1,000 periods of five day each. We rank the five-day deviations from the highest to the lowest, and then find the corresponding percentile

**Good**: conceptually simple and it works even when the underlying probability distribution is unknown. The approach requires the process to be stable, meaning the risk of assets hasn’t changed and that the number of past observations is sufficiently large to make an accurate estimate.

**Bad**: unchanging asset risk throughout the previous observation periods usually disqualifies this approach for derivatives and sometimes for alternative investments; The requirement of sufficient past observations is a challenge for illiquid alternative investments, such as private real estate and private equity.

### Describe how the Monte Carlo analysis can be used to estimate VaR

It is used in difficult problems when it is not practical to find expected values and standard deviations using mathematical solutions

### Discuss and apply the aggregation of portfolio-component VaRs to determine the VaR for a portfolio under various assumptions (i.e., perfect correlation, zero correlation, and perfect negative correlation)

1. Perfect positive correlation: VaR of the combination is simply the sum of individual VaRs

2. Zero Correlation

3. Perfect negative correlation: VaR(P) = 0

When positions are imperfectly correlated with each other, the VaRs should be combined using a model that incorporates the effects of diversification using statistics and correlation between the risks.

## Demonstrate knowledge of ratio-based performance measures used in alternative investment analysis.

### Define the ratio-based performance measure type

The numerator of the ratio-based performance measures is based on the expected return or the average historical return of the given asset. It usually takes one of the three forms:

1. The asset’s average return

2. The asset’s average return - a benchmark or target rate of return

3. The asset’s average return - riskless rate

The denominator can be virtually any risk measure, such as volatility, beta

### Define and calculate the Sharpe ratio

Sharp ratio compares the excess return per unit of total risk

Note: Quarterly SR

Bad: SR ignore the diversification effects and are primarily used in comparing returns only on a stand-alone basis.

SR is only as useful as volatility is useful in measuring risk. Thus, SR is less valuable measure of risk-adjusted performance for asset returns with non-normal distribution, as skewness and kurtosis are needed in addition to volatility.

Good:

1. Intuitive: SR reflects the added annual excess return per percentage point of annualized standard deviation

2. Measure of performance based on stand-alone risk, not systematic risk. Therefore, it does not reflect the marginal risk of including an asset in a portfolio when there is diversifiable risk

3. Sensitive to dimension. SR changes substantially if the unit of time changes, such as when quarterly rates are used rather than annualized rates.

4. Less usefully in comparing investment with returns that vary by skew and kurtosis

### Define and calculate the Treynor ratio

TR has excess return as its numerator and beta as the measure of risk as its denominator

TR

1. Intuitive. TR reflects the added annual excess return per unit of beta

2. Measure of performance based on systematic risk, not stand-alone risk. It does not reflect the marginal total risk of including an asset in a portfolio that is poorly diversified

3. Directly proportional to its dimension. TR (annual rates) = 4\* TR(quarterly rates)

4. Less useful in comparing investments with returns that vary by skew and kurtosis, because beta does not capture higher moments

### Recognize and calculate the Sortino ratio, the information ratio, and return on VaR

The Sortino ratio subtracts a benchmark return, rather than the riskless rate from asset’s return and uses downside standard deviation as the measure of risk

Sortino Risk = TSSD

Even target return = riskless rate, Sortino ratio is not equal to Sharp ratio due to different risk measures.

The information ratio uses difference between portfolio return and benchmark return in numerator, and tracking error as the risk measure.

Information Ratio = [\doubleE[R\_p] - R\_benchmark]/TE

Return on VaR is the expected return of an asset divided by a specified VaR

RoVaR = E[R\_p]/VaR

RoVaR may be useful when VaR is a good summary measure of the risks being faced.

## Demonstrate knowledge of risk-adjusted performance measures used in alternative investment analysis.

### Define the risk-adjusted performance measure type

In practice, a variety of performance measure should be viewed in a performance review, each of which is selected to view performance form a relevant perspective

### Recognize and calculate Jensen’s alpha, M2 (M-squared), and average tracking error

Jensen’s alpha is the difference between its expected return and the expected return of efficiently priced asset of similar risk.

Any return above the riskless rate and the required risk premium is alpha, which represents superior performance

Note: no assets offer a non-zero alpha in CAPM world, as all assets are priced efficiently in CAPM context. In practice, expected return on asset and market are not observable, so Jensen’s alpha is estimated using historical data instead

where

* is the estimated intercept, subject to levels of confidence
* is the estimated slope coefficients, the portfolio’s beta
* is the error term, the idiosyncratic return of the portfolio in time t

M-squared approach expresses the excess return of an investment after its risk has been normalized to equal the risk of the market portfolio.

Step 1: to leverage or deleverage each of the funds into a total portfolio that has the same volatility as the market portfolio. for example, for a fund with volatility 5%, with a total market volatility 10%, the manager would use 2:1 leverage, effectively allocating a weight of 200% to the fund and -100% to the riskless asset.

Average tracking error is the excess of an investment’s return relative to its benchmark. It is the numerator of information ratio.

# Chapter 6

## Demonstrate knowledge of the concept of informational market efficiency.

### Define informational market efficiency

The extent to which asset prices reflect available information. An informationally efficient market is a market in which assets are traded at prices that equal their values based on all available information (efficient market theory or efficient market hypothesis)

### Recognize various forms of informational market efficiency

The purpose of these 3 forms is to simplify and structure discussions of informationally efficient markets.

1. Weak form informational market efficiency (week level): market prices reflecting available data on past prices and volumes. Technical analysis no use in earning consistent and superior risk-adjusted returns

2. Semi-strong form informational market efficiency (semi-strong level): market prices reflect all publicly available information (both past and publicly available information now). Both technical and fundamental analysis has no use in earning consistent and superior risk-adjusted returns

3. Strong form informational market efficiency (strong level): market prices reflect all publicly and privately available information. Insider trading no use to earn consistent and superior risk-adjusted returns

### Identify factors driving informational market efficiency

There are 6 major factors to drive market efficiency. the first four to facilitate competition and to enhance liquidity, and the last two to facilitate better analysis

1. Greater value of asset traded, the greater competition for potential profits and losses from mis-pricing, within limits. However, very large asset values, such as huge equity deals, may reduce competition if there are relatively few traders who have the resources to acquire the assets

2. Greater trading frequency, by providing greater incentives for investors, speculators, and arbitrageurs to analyze information and attempt to make favorable trades.

3. Low levels of trading frictions, by encouraging arbitrage and speculation with the lowering of total trading costs. Trading frictions include transaction costs, brokerage fees, exchange fees, regulatory fees and taxes

4. Fewer regulatory constraints on trading, by expanding competition and trading. E.g. restrictions on short selling and leverage

5. Easier access to better information, by facilitating better financial analysis.

6. Less uncertainty about their valuation, or better valuation methods lead to better analysis. E.g. development of sound option pricing models in 1970s to improve efficiency in options markets

### Discuss the differences between informational market efficiency in traditional and alternative asset markets

Both traditional and alternative asset markets are quite diverse with regard to the first four factors. There are large, heavily traded markets, and small, thinly traded markets, in both traditional and alternative asset markets.

With regard to 5th and 6th factors: substantial nonpublic information and substantial uncertainty with regard to valuation methods. The practice and tools for investing in traditional assets tend to be better developed and more widely accepted. The complex trading strategies inherent in some alternative investment lend themselves to the discovery and exploitation of market inefficiencies. Hedge funds and private equity is accessible to a relatively limited number of traders and requires highly specialized tools. In contrast, long-only trading in traditional assets is accessible to numerous traders. Market efficiency is a vital tool in practice of alternative investing.

## Demonstrate knowledge of single-factor asset pricing models and ex ante pricing.

### Describe the key characteristics of single-factor asset pricing models

Return, systematic risk, and diversification

### Recognize the capital asset pricing model (CAPM)

CAPM has two parts: a risk-free rate to compensate time value; and risk premium to compensate for bearing risk.

The market portfolio is a hypothetical portfolio containing all tradable assets in the world, using market value as weight

### Describe the key characteristics of ex ante and ex post asset pricing models

Ex ante models provide an understanding of how return expectations or requirements are formed

Ex ante makes two powerful prescriptions related to alternative investments

1. All rewards for bearing risk should only be available from earning market risk, which can be fully measured by an asset’s beta relative to the market portfolio

2. Investors should not be able to earning any additional expected return from bearing any other type of risk

If CAPM were true, every investor would hold all risky assets in proportion to their size.

### Recognize the distinctions between ex ante asset pricing and ex post asset pricing

Two essential attributes of ex post CAPM are

1. The return form idiosyncratic risk has an expected value of zero

2. The return from idiosyncratic risk is not linearly correlated with the return of the market, as it’s captured by beta

Although ex post returns can be observed, the beta of investment is never observed, therefore e\_it can only be estimated.

## Demonstrate knowledge of multifactor and empirical asset pricing models.

### Apply and interpret equations representing ex ante and ex post forms of multifactor asset pricing models

A general ex ante form of multi-factor asset pricing model

Multi-factor models are primarily used as cross-sectional models that attempt to identify the return attributable to various systematic risk factors and therefore identify the portion of return differences across securities that would be attributable to idiosyncratic risk.

The most popular multi-factor model: Fama-French model, which links the returns of equities to two factors in addition to market factor:

1. A factor representing a growth vs value effect

2. A factor representing a size effect

### Distinguish between theoretically derived and empirically identified return factors

1. Theoretical model: factors are derived from reasoning based on known factors and relationships. e.g. model that recognizes returns of some alternative asset should depend on statistical parameters other than just mean and variance, such as skewness. another example: model linking returns of a hybrid security containing equity and bond features to market returns of equity markets and bond markets

2. Empirical model: derived from observation. e.g. model that recognizes the returns of some traditional assets are correlated with their market-to-book ratios. The key would be that factors were observed to be correlated using historical data rather than identified ahead of time based on arguments relying on well-established economic reasoning.

### Describe the steps typically involved in empirical modeling of returns

1. Risk free rate is subtracted from the past returns of each security or fund to form the excess return for each asset

2. Researcher selects a set of potential factors that serve as independent variables

3. Statistical analysis is used to identify those factors that are significantly correlated with the returns

### Recognize the key components of the Fama-French and Fama-French-Carhart models, and discuss the appropriate application of these models in alternative investing

Fama-French model

1. Market portfolio (same as CAPM)

2. Value vs growth effect (book-to-market ratio)

3. Small-cap vs large-cap effect (capitalization size)

**Fama-French-Carhart model**:

Adds a fourth factor: momentum. The idea is whether a common stock has risen or fallen recently helps explain subsequent performance. is the return to a diversified portfolio of winning stocks; while is the return to a diversified portfolio of declining stocks.

exposures as traditional assets. Therefore, FF and FFC models are of limited application.

### Discuss three key issues analysts should consider when using empirical multi-factor models

1. Widespread searches for statistically significant factors run the risk of false identification of useful factors (correlated, but no indication). Therefore, it is vital that factors be identified with solid theoretical reasoning, with rigorous statistical testing, or with both. For example, 90% confidence level with 50 IID variables, then there are 50\*10% = 5 variables that had no true relationship to returns.

2. Differentiating between factors that are correlated with returns and those that cause returns.

3. Using an empirical multi factor model lies in justifying why it should perform better than CAPM in describing the trade-off between risk and return. I.e. why would investors choose high exposures to some factors and low exposures to others when the CAPM implies that all investors obtain their highest expected utility from allocating to market-weight exposures?

Note: for traditional case, investors tend to fully diversify into a market-weighted portfolio, while alternative investments, it depends on multiple factors, as it’s impossible to invest in a market-weighted portfolio of alternative investments (many privately held)

## Demonstrate knowledge of arbitrage-free financial models.

### Describe arbitrage-free models

A financial model with relationships derived by the assumption that arbitrage opportunities do not exits, or at least do not persist

### Discuss applications of arbitrage-free models

Arbitrage-free pricing models are used in the analysis of interest rates, foreign exchange rates, derivatives and other areas, such as cash-and-carry trades. Relative pricing models, which prescribes the relationship between two prices.

### Describe arbitrage-free pricing in spot markets

spot market or cash market is any market in which transactions involve immediate payment and delivery. Arbitrage-free pricing in spot markets involves identifying two sets of transactions with identical outcomes and requiring that their prices be equal.

### Describe hedged and unhedged carry trades

Carry trades are typically a set of long and short positions intended to generate perceived benefits through time. Carry trades can be either be hedged or exposed to risk.

### Define forward contracts, and recognize their uses in hedging

A forward contract is simply an agreement paling for deferred delivery of an asset of a payoff.

where yield to maturity offered on a forward contract over interval between maturity of short term T-bill and maturity of long term T-bill.

### Recognize and apply cost-of-carry models

Financed positions enable economic ownership of an asset without the posting of the purchase price. A financial position is any economic exposure that is obtained with zero net immediate investment.

### Discuss and apply binomial tree models

Binomial tree models are often used to price equites, fixed-income securities, and derivatives. A binomial tree model projects possible outcomes in a variable by modeling uncertainty as two movements: an upward movement and a downward movement. (1. Risk neutral to calculate probability; 2. Calculate the payoff)

## Demonstrate knowledge of the term structure of forward contracts.

### Identify the two determinants of forward prices on a risky financial security

The only difference between buying a financial security in the spot market and establishing a long position in a forward contract on that security is the timing of exchange.

1. Payment for the underlying asset is deferred until delivery

2. Dividends or other cash flows generated by the underlying asset are received by the owner of the asset, but not by the long position in the forward contract

As a result, given cash prices, there are two factors to determine forward prices

1. Riskless interest rate, or financing rates associated with the deferred payment for the underlying asset

2. Dividends and other distributions paid during the period of deferral

F= S + financing cost - dividends paid

### Compare the pricing of forward contracts on financial securities and commodities

Forward prices only depends on current market values (risk-free rate and dividend rate), instead of expected market values

Commodity forward prices and the term structure of forward prices on commodities often do not adhere to a strict cost-of-carry relationship for several reasons. while the forward structure’s shape for financial forwards is driven purely by interest rates and distributions. The forward structure’s shape for commodities is driven by at least 3 additional factors:

1. Forecasts of supply and demand changes

2. Storage cost differentials

3. Convenience yield differentials

### Apply the cost-of-carry model for pricing forward contracts on financial securities

Forward contract on financial securities

Case 1: no dividend and no interest

Note the relationship is based on absence of arbitrage opportunities, and any other relationship between prices would allow trades to earning riskless profits

Case 2: Interest rate = dividend rate

The return structure of forward prices is flat.

Case 3: Interest rate > Dividend rate

F(T) is higher for higher T

Case 4: Interest rate < Dividend rate

F(T) is lower for higher T. the cash distributions lower the value of a financial asset

## Demonstrate knowledge of option exposures.

### Recognize the key characteristics of long and short positions in an underlying asset

An option is a contract that allows its owner the right to execute a specified transaction in the future.

### Recognize the key characteristics of call and put exposures

Covered call: long an asset with short a call option on the same asset

Protective put: long an asset with long a put option on the same asset

### Discuss characteristics of option spreads

An option spread

1. Contains either call options or put options (not both)

2. Contains both long and short positions in options with the same underlying asset

### Define bull and bear spreads

Consider one long position and one short position in either two calls or two puts that different only by strike prices.

**Bear** **spread**: long option position is at the higher of two strike prices, which offers bearish exposure to the underlying asset

**Bull** **spread**: long lower, and short higher

### Discuss option combinations

An option combination contains both calls and puts on the same underlying asset.

**Option straddle**: long a call and a put with the same underlying asset, expiration date and strike price

**Option strangle**: long a call and a put with the same underlying asset, expiration date but different strike prices

**Option collar**: long a put and short a call

### Define and apply the concept of put-call parity

Call + Bond - Put = Underlying Asset

## Demonstrate knowledge of option pricing models.

### Recognize and apply the Black forward option pricing model

Black option pricing model for a call option on a forward contract

### Recognize and apply the currency option pricing model

Option value (currency) =

where r\* is the foreign risk free rate while r is the domestic risk free rate

## Demonstrate knowledge of option sensitivities.

### Discuss option sensitivities

**Elasticity** is the percentage change in a value with respect to a percentage change in another value

**Lambda** or **omega** is often used to indicate the elasticity of an option price with respect to the price of the option’s underlying asset. Thus lambda or omega for a call option is the elasticity of an option price with respect to the price of the underlying asset and is equal to delta \times quality (S/c)

### Discuss the uses of option sensitivities in risk management

1. Traders use sensitivities to establish hedge ratios

2. To manage all potential risk exposures

Note: a total derivative measures the direction of the change and is accurate for infinitesimal changes.

# Chapter 7 Benchmarking and Performance Attribution

## Demonstrate knowledge of benchmarking and its role in the analysis of risk and return of investments.

### Define benchmarking in the context of investing

Benchmarking is the process of selecting an investment index, an investment portfolio, or any other source of return as standard (or benchmark) for comparison during performance analysis.

### Recognize various types of benchmarks (i.e., peer returns and index returns)

There are two general types of benchmark returns that might be used in the analysis of fund performance: **peer** and **index**

1. **Peer** **benchmark** is based on the returns of a comparison or peer group. The **peer** **group** is typically a group of funds with similar objectives, strategies, or portfolio holdings.

2. **Indices** typically reflect weighted averages of the returns of a set of securities or funds. Indices tend to be used for a more general audience and are often available for use by a variety of investors to gauge the performance of an investment, a market, or a sector.

### Discuss considerations in benchmarking

1. Appropriateness of the benchmark selected

2. Statistical significance of performance differences relative to a benchmark

3. Reasons behind performance differences relative to a benchmark

## Demonstrate knowledge of various types of asset pricing models.

### Define normative and positive models, and compare their key characteristics

1. **Normative model** attempts to describe how people and prices ought to behave. It tends to be most useful in helping explain underlying forces that might drive rational financial decisions under *idealized* circumstances. It can be used to identify the potential mis-pricing of securities by identifying how securities should be priced. e.g. arbitrage-free pricing models are normative models

2. **Positive model** attempts to describe how people and prices actually behave. It tries to explain past behavior and then predict future behavior. It is often used to try to identify mis-pricing of securities by recognizing patterns in *actual* price movement.

Alternative investment analysis uses both normative and positive modeling.

### Define theoretical and empirical models, and compare their key characteristics

1. **Theoretical** **model** describe behavior using deduction and assumptions that reflect well-established underlying behavior. It tends to explain behavior accurately in more simplified situations, in which the relationships among variables can be somewhat clearly understood through logic. e.g. arbitrage-Free models are developed by theory.

2. **Empirical model** tends to explain complex behavior relatively well when there are many data points available and when the relative behavior of the variables is fixed or is changing in predictable ways. e.g. frequently traded but extremely complex security with many overlapping option features.

Alternative investing tends to lend itself more to empirical models than to theoretical models, as alternative investments tend to be characterized by illiquidity, changing risks, dynamic strategies, or other complexities that can foil theoretical modeling.

### Define applied and abstract models, and compare their key characteristics

1. **Applied model** is designed to address immediate real-world challenges and opportunities. e.g Markowitz’s model

2. **Abstract** **model** (basic model) tends to have applicability only in solving real-world challenges of the future. Abstract models tend to be theoretical models that explain hypothetical behavior in less realistic scenarios. It leads to innovative applications.

Models in alternative investing are applied models. they are intended and used for solving immediate real-world problems.

### Define cross-sectional and time-series approaches, and compare their key characteristics

1. **Cross-sectional model** is used throughout economic modeling in alternative investments. It analyzes behaviors at a single point in time across various subjects, such as investors or investments

2. **Time-series model** analyzes behaviors of a single subject or a set of subjects through time

**=> Panel data set** combine two approaches and includes multiple subjects and multiple time periods

## Demonstrate knowledge of various approaches to performance attribution.

### Describe the characteristics of single-factor models

In CAPM, the idiosyncratic return is not attributable to its market risk.

An estimated single-factor time series model is typically written like

The equation parameters a and \beta are usually estimated using a regression method, which is performed for a particular asset i

### Interpret the results of single-factor benchmarking analysis

Benchmarking with a single-factor linear regression model, in which the benchmark takes the place of the market factor:

where a and b are based on linear regression; a is an estimate of the average over-performance or underperformance of the fund; b is the sensitivity of the fund’s return to the benchmark’s return; e\_t is the fund’s estimated idiosyncratic return above or below its risk-adjusted return.

For example, a=1.3% and b = 0.68 means Fund outperformed its benchmark by 1.3% per year while taking only 68% of the systematic risk of benchmark.

### Discuss multi-factor benchmarking

For example, analysis of return for Fund using FFC model

Fund A: -2.91% | 0.66 | 0.16 | 0.10 | 0.15

Now the Fund underperforms benchmark by 2.91% using multiple factors. Apparently, the single-factor model was erroneously identified as an indication of superior return rather than as compensation for the omitted risk exposures that the fund was incurring by investing in small-capitalization value stocks with a high degree of momentum.

In up market, the omission of systematic risk factors will result in an analysis that overestimates the risk-adjusted performance of assets positively exposures to the omitted risk factors, and underestimates the performance of assets negatively exposures to the omitted risk factors.

## Demonstrate knowledge of the limitations of the CAPM approach for analysis of alternative investments

There are three primary reasons why CAPM may not work for alternative investing

1. Multi-period issues

2. Non-normality

3. Illiquidity of returns and other barriers to diversification

### Recognize and describe multi-period issues in CAPM analysis

The CAPM is a single-period model, in which it is assumed that all investors can make an optimal decision based only on analysis of the outcomes at the end of one period. For CAPM to hold in a world of multiple periods, the market’s return is assumed to behave in similar patterns through time. If not, additional systematic risk factors will emerge, and a single-factor approach may not work.

### Recognize and describe the limitations of CAPM analysis when applied to non-normal return distributions in alternative investments

CAPM only relies on mean and variance. Alternative investment returns often tend to skew to one side or the other or to have excess kurtosis, with fatter tails on both sides.

### Describe the potential effect of illiquidity on returns of alternative investments

The idea in CAPM is every investor should seek perfect diversification through holding market portfolio is predicted on perfect liquidity. The effect of illiquidity on returns of alternative investments:

1. There are substantial barriers to perfect diversification, such as transaction costs, taxes, and differential taxation.

2. Illiquidity may be priced

3. Illiquidity restricts an investor’s ability to adjust a portfolio continuously, including manager’s ability to control risks and manage cash.

4. Hampers valuation, risk measurement, risk management, and decision marking

# Alpha, Beta, and Hypothesis Testing

## Demonstrate knowledge of beta and alpha.

### Recognize the role of beta in the analysis of traditional and alternative investments

**Beta** is specified as the covariance of the asset’s return with the return of the market portfolio, divided by the variance of the return of the market portfolio. Intuitively, beta is the proportion by which an asset’s excess return moves in response to the market portfolio’s excess return.

In CAPM framework, beta refers to a measure of risk, or bearing of risk, wherein the underlying risk is systematic. Outside CAPM, assets can have more than one beta.

### Recognize the role of alpha in the analysis of traditional and alternative investments

Alpha refers to any excess or deficient investment return after the return has been adjusted for time value of money and effects of bearing systematic risk (beta). for an investment strategy, alpha refers to the extent to which the skill, information, and knowledge of an investment manager generate superior risk-adjusted returns.

## Demonstrate knowledge of the concepts of ex ante and ex post alpha.

### Define and apply the concept of ex ante alpha, and identify its key characteristics

**Ex ante alpha** is the expected superior return if positive offered by an investment on a forward-looking basis after adjusting for the riskless rate and systematic risks.Ex ante alpha is generated by deliberate over- or under-allocation to misplaced assets based on investment management skill. In single factor model, ex ante alpha is \alpha\_i

In a perfectly efficient market, \alpha\_i would be zero for all assets.

In practice, ex ante alpha is a concept rather than an observation variable, and it must be estimated.

1. \beta\_i must be estimated by approximation

2. All variables in above formula is not observable and must be estimated except risk free rate

### Define and apply the concept of ex post alpha, and identify its key characteristics

**Ex post alpha** is the return, observed or estimated in retrospect, of an investment above or below the risk-free rate and after adjusting for the effects of beta (systematic risks). It’s **realized** idiosyncratic return. Simply put, ex post alpha is the extent to which an asset outperformed or underperformed its benchmark in a specified time period.

In the context of single factor model, ex post alpha is the e\_it

### Distinguish between ex ante and ex post alpha

The key difference: ex ante alpha reflects skills, where ex post alpha can be a combination of both luck and skill. The difference mainly depends on wording: based on past vs expectation

## Demonstrate knowledge of empirical approaches to inferring ex ante alpha from ex post alpha

### Identify the steps involved in estimating ex ante alpha from historical performance

**Step** **1:** An asset pricing model or benchmark must be used to divide the historical returns into the portions attributable to systematic risk (and risk free rate) and those to idiosyncratic effects

**Step** **2**: the remaining returns (idiosyncratic returns, or ex post alpha) should be statistically analyzed to estimate the extent to which superior returns may be attributable to skill rather than luck

### Discuss challenges to empirical analysis of manager skill

1. Model mis-specification is any error in the identification of variables in a model or any error in identification of the relationships between the variables

2. Easy to make incorrect inferences

## Demonstrate knowledge of return attribution.

### Calculate beta, ex ante, and ex post alpha

1. Ex ante alpha = expected return - required return

2. Ex post alpha is based on ex post version of single factor market model

3. The expected returns are necessary only to estimate ex ante alpha and to distinguish between luck and skill.

### Recognize the three primary types of model misspecification (i.e., omitted systematic return factors, misestimated betas, and nonlinear risk-return relationships) and their effects on return attribution

1. Omitted (or mis-identified) systematic return factors: not precisely identified. for example, if Fund’s return is driven by four betas. If two factors are ignored, then the estimate of the idiosyncratic return will contain the expectation of two missing effects.

2. Mis-estimated betas

3. Nonlinear risk-return relationships: exists when functional relationship between a systematic risk factor and asset’s return is mis-specified. If the true relationship is non-linear, but we used a linear model

### Describe various types of beta non-stationarity (i.e., beta creep, beta expansion, and market timing) and their effects on return attribution

**Beta non-stationarity** refers to the tendency of the systematic risk of a security, strategy, or fund to shift through time.

1. **Beta creep**: when hedge fund strategies pick up more systematic market risk over time. As a result, the amount of systematic risk in the portfolio will creep upward over time when more funds flow to hedge fund managers

2. **Beta expansion**: perceived tendency of the systematic risk exposures of a fund to increase due to changes in general economic conditions. Effect is increased correlation between the hedge fund’s returns and market returns

3. **Market timing**: Intentional shifting of an investment’s systematic risk exposure by its manager. It makes return attribution more problematic, since the level of beta between reporting periods would typically be very difficult to estimate accurately.

### Discuss how alpha and beta can become commingled

Strategy in PE requires exposures to systematic risks that cannot be hedged. One can argue any superior return is ex ante alpha; or beta as high returns are achieved only through bearing systematic risk of the sector.

## Demonstrate knowledge of ex ante alpha estimation and return persistence

### Recognize the characteristics of return persistence

Past performance is not indicative of future results

### Define abnormal return persistence

**Abnormal return persistence** is the tendency of idiosyncratic performance in one time period to be correlated with idiosyncratic performance in subsequent time period.

### Discuss attribution of idiosyncratic returns to luck or skill

1. Estimate the average idiosyncratic returns (ex post alpha) for each asset in time period 1

2. Estimate the average idiosyncratic returns (ex post alpha) for each asset in time period 2

3. Statistically test whether the ex post alpha in time period 2 are correlated with the ex post alpha in time period 1

## Demonstrate knowledge of return drivers

### Discuss the classification of assets into beta drivers and alpha drivers

1. **Beta driver**: an investment that moves in tandem with the overall market or a particular risk factor

2. **Alpha driver**: an investment that seeks high return independent of the market

Alternative investments tends to focus more on alpha drivers, whereas traditional investing tends to focus more on beta drivers

### Discuss the characteristics of beta drivers and their behavior over time

**ERP** (Equity Risk Premium) is the expected return of the equity market in excess of the risk free rate

**Equity risk premium puzzle** is the enigma that equities have historically performed much better than can be explained purely by risk aversion.

### Discuss passive beta drivers as pure plays on beta

1. **Passive investing**, such as employing a buy-and-hold strategy to match a benchmark index, is a pure play on beta.

2. **Linear risk exposure**: return is a linear function of market return

3. **Passive beta driver strategy** generates returns that follow the up-and-down movement of the market on a one-to-one basis. in this sense, pure beta drivers are linear in their performance compared to a financial index

### Discuss the characteristics of alpha drivers

Alpha drivers seek excess return or added value through generating returns that exceed the returns on investments of comparable risk.

### Discuss product innovators and process drivers

Two developments among beta drivers

1. **Product innovators**: alpha drivers that seek new investment strategies offering superior rates of risk-adjusted return

2. **Process drivers**: focus on providing beta that is fine-tuned or differentiated. e.g. ETF tracking specific sectors of market

## Demonstrate knowledge of statistical methods for locating alpha

### Identify the four steps of hypothesis testing (i.e., state the hypothesis, formulate an analysis plan, analyze sample data, and interpret results)

1. State a null hypothesis and an alternative hypothesis to be tested

2. Design a statistical test

3. Uses sample data to perform the statistical test

4. Rejects or fails to reject the null hypothesis based on results of the analysis

### Recognize the components of hypothesis statements (i.e., null hypothesis and alternative hypothesis)

1. **Null hypothesis**: usually a statement to reject. e.g. a variable no effect; parameter’s true value is not zero

2. **Alternative hypothesis**: would be true if the null hypothesis were rejected

### Describe the process of designing hypothesis tests

1. Specify the variables for a model

2. The relationship between the variables

3. Statistical properties of the variables

### Describe the process of creating test statistics for use in analyzing sample data

Test statistic = (Estimated value - hypothesized value) / (standard error of statistic)

### Recognize the four common problems with using inferential statistics (i.e., misinterpretation of high p-values, failure to distinguish between statistical significance and economic significance, violation of distributional assumptions, and misinterpretation of level of confidence)

1. Outcomes with lower p-values are sometimes interpreted as having stronger relationships than those with higher p-values. But p-value is not a reliable indicator of the size and strength of relationship

2. Failure to distinguish between statistical significance and economic significance. **Economic significance**: an economic model has a meaningful impact on another variable in a practical sense.

3. P-value is only as meaningful as the validity of the assumption regarding the distribution of test statistic.

4. P-value is interpreted as unconditional probability that a statistically significant result it true.

### Define and discuss type I and type II errors in hypothesis testing

1. **Type I error**, aka false positive, is when an analyst makes the mistake of falsely rejecting a true null hypothesis. Let \alpha be level of confidence, then 1-\alpha is the type I probability

2. **Type II error**, aka false negative, is paling to reject the null hypothesis the it is false. Let \beta be probability of Type II error, then 1-\beta is the statistical power of a test.

H0 True H0 False

Reject H0 Type I error Correct

Fail to reject H0 Correct Type II error

## Demonstrate knowledge of sampling and testing problems

This section discussed potential problems when sample is not representative of the population or is not correctly interpreted.

### Recognize the characteristics of unrepresentative data sets and their effects on test results

1. **Selection bias**: distortion in relevant sample characteristics from the char of population, caused by the sampling method of selection or inclusion.

2. **Self-selection bias**: when the selection bias originates from the decision of fund managers to report or not to report returns

3. **Survivorship bias**: the sample is limited to those observations that continue to exist through the end of the period of study. Funds that liquidated, failed, or closed would be omitted.

### Discuss data mining and data dredging, and recognize their effects on test results

1. **Data mining**: vigorous use of data to uncover valid relationships. The idea is to use a variety of well-designed statistical tests and exploring a number of data sources, analysts may uncover previously missed relationships.

2. **Data dredging** (or data snooping) refers to the overuse and misuse of statistical tests to identify historical patterns.

The **difference**: data dredging involves performing too many tests, especially regarding historical relationships

### Discuss backtesting and backfilling, and recognize their effects on test results

1. **Backtesting**: the use of historical data to test a strategy that was developed subsequent to the observation of data. It can be used as an indication of the strategy’s potential going forward. It is dangerous when model involves overfitting.

2. **Backfilling**: the insertion of an actual trading record of an investment into a database when trading record predates the entry of the investment into the database. E.g. inclusion of a hedge fund into a database in 2015, along with the results of the fund since its inception in 2010. Backfilling can also refer to the use of hypothetical data from backtesting, and refer to the insertion of hypothetical trading results into a summary of an investment opportunity.

Backfill bias: when the funds, returns, and strategies being added to a data set are not representative of the universe of fund managers, fund returns, and fund strategies.

### Discuss cherry-picking and chumming, and recognize their effects on test results

1. **Cherry-picking**: extracting or publicizing only those results that support a particular viewpoint.

2. **Chumming**: fishing term to describe scattering pieces of cheap fish into the water as bait to attract larger fish to catch. e.g. unscrupulous internet-based newsletter writer who sends 10 ,million emails, 5 million of which forecast that a particular stock will rise and 5 million of which forecast that it will fall.

## Demonstrate knowledge of statistical issues in analyzing alpha and beta

Challenges to alpha estimation: **non-normality** of underlying data, **outliers**, and **biased** **testing**

### Recognize the effect of non-normality on the cross-sectional search for alpha

Returns are not normally distributed. Cross-sectional return differentials exist, but dispersion alone does not mean that skill is involved. In fact, the existence of any thickness or length to the tails of a frequency distribution of fund returns provides little or no evidence that the dispersion is caused by skill rather than luck.

### Identify the potential effects of outliers on reported results

**Outlier**: an observation that is markedly further from the mean than almost all other observations. Outliers tend to have large impacts on results, and an exceptionally usually outlier may severely distort the measurement of the economic tendencies of the data in traditional tests, especially for small samples.

### Recognize issues involving biased testing in the search for alpha

Two issues of biased testing

1. Fund selected at random, or fund identified prior to the sample period analyzed?

This issue speaks to the tendency to observe a fund that has performed well and then to test if the performance is statistically superior.

2. Test procedures fully specified prior to the analysis of any results?

This issue speaks to the specification of the test and the importance of avoiding data dredging. Each statistical test involves numerous decisions, and it’s vital that these decisions are made prior to the conduct of the test to avoid varying specifications in search of more favorable result.

### Discuss the challenges of spurious correlation in beta estimation

Challenges to alpha estimation, plus the following

1. Differentiating between spurious correlation and true correlation: **spurious correlation** is idiosyncratic in nature, coincidental, and limited to a specific set of observations (correlation depends on time period).The estimated correlation is being driven both by true correlation and by spurious correlation.

2. Differentiating between true correlation and causality: causality reflects one variable is (partially) explained by another variable.

When economic reasoning indicates a causal relationship between two variables, analyst can be more confident that an observed correlation is true rather than spurious.

### Recognize three major fallacies of alpha estimation and the lessons that arise from them

Alpha estimation is central to detecting potentially enhanced returns, while beta estimation is central to measuring the non-diversifiable risks of investments.

1. If all funds under analysis can reasonably be assumed to have highly similar systematic risk exposures, then if the analyst identified numerous funds with statistically better performance (e.g. 12 /100 with 5% level of significance), the analyst should infer that some of the superior performance is attributable to managerial skill.

**Reason**: unexplained returns non-normal

**Lesson**: returns should be analyzed using a risk-adjusted standard, rather than comparing to each other

2. If the analyst examines an investment and estimates ex post alpha as intercept of a time-series regression of investment’s return using a multi-factor asset pricing model, then a statistically positive alpha indicates that the investment earned a higher-than-average risk-adjusted return.

**Reason**: model mis-specification, e.g. omission of a type of systematic risk factor, which will cause the estimate of idiosyncratic performance (alpha) to contain returns from bearing systematic risk.

**Lesson**: hypothesis test is usually based on critical assumptions, so a test using particular asset pricing model is only as reliable as the model itself.

3. Assuming that the asset pricing model is well specified, meaning it correctly captures and models all important systematic risks.

**Reason**: level of significance is not the probability that the H0 is false if a statistically significant result is found. The proper conclusion is that with a well-specified model, a fund that has zero ex ante alpha has only 1% chance of being incorrectly estimated as having a nonzero ex ante alpha.

### Recognize two major fallacies of beta estimation and the lessons that arise from them

1. The coefficient is statistically zero means that the investment’s return was not related to that return factor

**Reason**: traditional correlation measures a linear response between variables, but may not capture some nonlinear relationships, such as U-shaped.

**Lesson**: alternative assets tend to contain nonlinear risk exposures and complex statistical techniques suited to studying nonlinear relationships may need to be employed.

2. A statistically significant nonzero beta in a well-specified model indicates that the return factor causes at least part of the investment’s return

**Reason**: correlation can be different from causation.

**Lesson**: economic intuition should play a role alongside empirical techniques to avoid mis-interpretation of spurious correlation and to lessen the probability of data dredging.

# Chapter 9: Regression, Multi-variate, and Nonlinear Methods

## Demonstrate knowledge of single-factor regression models.

### Explain the use of ordinary least squares to estimate regression parameters

The ordinary least squares regression selected the intercept and slope that minimize the sum of the squared values of the residuals. It can generate unbiased estimates if the error terms are normally distributed; uncorrelated; and homoskedastic.

### Describe the problem outliers pose to regression analysis

Violations of error normality assumption often occur when the data are subject to very large outliers

**Problem** 1: fat tails. Large outliers dominate a regression, potentially causing the estimates of the slope and intercept to be driven too much by the outliers, rather than by the remaining, more representative data.

**Response** 1: visual observation of the residuals of the regression. Residuals plotted against independent or explanatory variable. If the extreme residuals are not the result of errors, then determine: if the outlier is caused by an event not reasonably expected to not recur, perhaps the outlier should be removed.

### Describe the problem autocorrelation poses to regression analysis

**Problem** 2: auto-correlation. Violation of uncorrelated error assumption often occur when returns are autocorrelated. Many alternative investment return series are especially prone to auto-correlation due to smoothed pricing or illiquidity.

**Response** 2: Durbin-Watson statistic is used to test for auto-correlation of residuals. If yes by test, there are several well-established statistical procedures for performing adjusted regressions that provide better results.

Note: first order autocorrelation is a common phenomenon in alternative investments and is reasonably easy to address.

E.g. residual autocorrelation may indicate the X were reflecting values changes on a delayed basis.

### Describe the problem heteroskedasticity poses to regression analysis

**Problem** 3: Heteroskedasticity, where the variance of error term may be correlated with an independent variable, may vary through time, or may be related to some other variable or dimension.

**Response** 3: Residuals should be plotted against the independent variable and against time

### Interpret a regression’s goodness of fit

**Goodness of fit** of a regression is the extent to which the model appears to explain the variation in the dependent variable. R-squared is simply the squared value of the estimated correlation coefficient between the dependent variable and the independent variable

### Evaluate the statistical significance of regression parameter estimates

R-squared = 90% means the independent variable explained 90% of the variation in the dependent variable. I.e. 90% of fund’s returns were explained by the systematic risk. The remaining 1-r^2 is the idiosyncratic risk, or the risk no explained by the market index

### Calculate the t-statistic

The 2nd major interpretation of a regression’s results is testing the significance of the parameter estimates. T-test is leveraged to reject or fail to reject a hypothesis by comparing t-statistic to a critical value

## Demonstrate knowledge of multi-factor regression models.

### Describe the ex post version of the Fama-French model

A typical result of adding more true factors to a model is that r-squared increases and alpha estimate declines. The estimated alpha typically declines, as returns that were previously attributed to the intercept (alpha) are now explained by systematic risk exposures to the anomaly factors of size and value (beta). The key challenge is deciding which independent variables (factors) to include

### Describe the problem that multicollinearity poses to multi-factor regression analysis

**Multi-collinearity** is when two or more independent variables in a regression model have high correlation to each other. When two independent variables are highly correlated, there are two primary adverse effects to regression results:

1. The estimates of the slop coefficients for each of the correlated independent variables may be highly inaccurate

2. The standard errors for the correlated independent variables may be inflated (large)

With multicollinearity, even though the r-squared of a regression may be high, it can be difficult to find independent variables with coefficients that have significant t-statistics.

Corrections of multi-collinearity: to form return spreads between the correlated independent variables. The estimated slope coefficients for each of the highly correlated factors would be unreliable and are likely to be statistically insignificant. One way is to use variable A as one variable and use B-A as another variable. This transformation serves to reduce the correlation between the independent variables, now making it possible to better separate the effects of each market segment independently.

### Discuss the selection process of independent variables for multi-factor regression analysis and the potential shortcomings to the stepwise regression technique

A stepwise regression technique is used. It is an iterative technique in which variables are added or deleted from the regression equation based on their statistical significance. At each step, the variables with the greatest t-statistics are added or retained in the model, and variables with insignificant t-statistics are deleted from the model.

## Demonstrate knowledge of dynamic risk exposure models

### Define nonlinear exposure

A nonlinear exposure of a position to a market factor is when the sensitivity of position’s value varies based on magnitude of the level of change win the market factor’s value. (i.e. 1st derivative not constant)

### Discuss and apply the dummy variable approach to analyzing market-timing strategies

The effectiveness of market-timing strategies can be analyzed by a comparison of their average risk exposures to up markets and their average risk exposures to down markets.

The dummy variable D\_1 is set to equal to 1 when excess returns on the market index; R\_mt - R\_f are positive and set to zero when the excess returns are zero or negative; The **down market beta**, b\_id, is the responsiveness of the fund’s return to the market return when the market return is less than the riskless rate (i.e. excess return is negative). The up market beta b\_{i,u} is the responsiveness of the fund’s return to the market return when the excess market return is positive.

### Discuss the separate regression approach to analyzing market-timing strategies

A similar approach to dummy variable is to perform separate regressions based on sub-samples. The analyst simply breaks the data set into multiple sub-samples based on specified conditions (e.g. rising and down markets)

### Discuss and apply the quadratic approach to analyzing market-timing strategies

U-shaped profit-loss diagram. A statistically significant and positive b\_im on the squared term is an indication that the manager has been able to successfully time the market, earning positive returns in both strong risking and strongly falling market. A significant negative value of indicates that the manager has perverse market-timing skills.

## Demonstrate knowledge of methods for modeling changing correlation

Two methods to model changing correlations

1. Conditional correlation

2. Rolling window modeling approach

### Recognize and describe the concept of conditional correlation

A conditional correlation is a correlation between two variables under specified circumstances. Positive conditional correlation of investment returns is when the correlation in the up sample is higher than the correlation in the down sample.

### Describe the rolling window approach to modeling changing correlation

**Rolling window analysis** is a relatively advanced technique for analyzing statistical behavior over time, using overlapping subsamples that move evenly through time. A rolling window analysis chooses a time width for the window, e.g. 36 months, and performs regression or correlation analysis for each contiguous 36 month period in the data. The sub-periods use overlapping data as the window moves from the first 36 months of data to the last 36 months of data. For example, 10 years of data, a rolling window of 36 months would produce 85 unique outputs: 1 to 36, …, 85 to 120

**Example**: 50-week rolling window analysis for four years of data (208 weeks). there would be 158 windows of analysis, but there would be only four independent analysis, such as 1-5-, 51-100, 101-150, and 151-200.

## Demonstrate knowledge of approaches to analyzing hedge fund returns using multi-factor models

### Describe how style analysis and asset class groupings can be used to analyze fund performance

**Style analysis** is the process of understanding an investment strategy, especially statistical approach, based on grouping funding’s by their investment strategies or styles. **Typical** **question**: funds of same investment style have returns be explained by the same underlying return factors?

Sharpe’s style analysis

1. Groups mutual funds by their stated investment styles

2. Analyze the performance of each group relative to the performance of various potentially underlying asset classes

Shape regresses mutual fund returns on the returns of various asset classes. His results indicate that up to 90% of each mutual fund’s returns are explained by returns of a few underlying asset classes. The balance (remaining) of returns may be attributable to manager skill, including security selection and market timing, or luck.

In summary, traditional mutual fund returns are well explained by the returns of asset classes that the funds hold, but the same is not true for hedge funds.

### Describe how performance of a fund can be analyzed using returns of funds with similar strategies

**Principal components analysis** (PCA) is a statistical technique that groups the observations in a large data set into smaller sets of similar types baed on commonalities in the data. Thus, PCA identifies subgroups of observations that tend to behave similarly. FH group return of hedge funds into 5 categories

1. Systems/opportunistic

2. Global macro

3. Value

4. Systems/trend following

5. Distressed

These 5 fund styles explain about 45% of cross sections variation in hedge fund returns. Their work suggests that cross sectional hedge fund returns are better explained by their trading styles than by their correlations with traditional asset classes. E.g. return of a global macro fund tend to be explained better by fund’s tendency to behave like other global macro funds than by its mixture of underlying traditional asset classes.

### Describe how market-wide factors can be used to analyze performance of a fund

FF indicates that individual equity returns can be explained by identifiable marketwise factors, e.g. size. The key is arbitrage-free model of returns. Researcher develop relevant factors by

1. Developing a concept of how the returns experienced by underlying securities in the market might vary based on a particular variable

2. Dividing the sample into two subgroups based on that variable

3. Estimating the reign spread from being long one of the group and short the other group

4. Empirically examining whether returns from the entire sample of securities are consistently explained by the return spread

There are 3 distinguishing characteristics to multi-factor analysis using marketwise return factor

1. Using **tradable** **factors** that are identified as the spread between the return of two groups of stocks (e.g. return of small-cap stocks minus the return of large-cap stocks

2. Using **empirically** **identified** factors rather than factors identified with theory

3. For each asset, finding **empirically** **estimated** **exposures** to the factors rather than risk exposures identified through fundamental analysis of the asset of fund

When factors are tradable, there are 2 important economic implications

1. The intercept of the model in an efficient market must be equal to the riskless rate

2. The model itself can be described as an arbitrage-free relationship

FH propose 7 observable and tradable factors

1. The return of S&P 500 - risk-free return

2. Small-cap stock return - large-cap stock return

3. The return of 10-year Treasury bond - risk-free return

4. The return of Baa-rated bonds - return of 10-year Treasury bond

5. The return of portfolio of call and put options on bonds

6. The return of portfolio of call and put options on currencies

7. The return of portfolio of call and put options on commodities

Note: 5, 6, and 7 are constructed to mimic the behavior of look-back options, which has a payoff based the value of underlying asset over a reference period rather than simply the value of underlying asset at option’s expiration date. FH claims that 90% of return can be explained by those 7 factors. Note: not so good for hedge funds

### Describe how specialized market factors can be used in hedge fund replication

Hedge fund replication is the process of mimicking the performance of a particular hedge fund investment strategy using different assets or a different investment process. Two replication approaches

1. Use liquid products to replicate illiquid securities

2. To replicate returns of skill-based proprietary strategy using a naive and mechanical trading model applied o positions similar to the positions being held by the fund being replicated.

In the context of multi-factor return models, hedge fund replication involves identifying specialized market factors, and estimating the fund exposures to those factors.The difference btw this approach and market-wide factor approach: the factors are selected to be tailored to the specifics of a particular fund rather than watered as market-wide factors. Note: the factors in a market-wide approach are selected on how they explain returns of all assets in a market.

## Demonstrate knowledge of estimating hedge fund performance persistence

### Discuss approaches to estimating hedge fund performance persistence

1. To examine the correlation between samples of earlier returns and subsequent returns

2. Empirical analysis of return persistence vary by time periods analyzed, time intervals used, and investments examined

**Problem 1**: results could be driven by serial correlation of returns, not reflecting performance correlations.

**Problem 2**: asset returns are not risk-adjusted. as high-risk assets should consistently generate higher returns than low-risk assets, return persistence in a sample may simply reflect heterogeneous risks.

Solution: To focus on risk-adjusted measures of skill and estimate whether a measure of skill in one period is correlated to the same measure of skill in a subsequent period. The issue is: results are sensitive to the model used to adjust for risk.

# Chapter 10 Real Assets

## Demonstrate knowledge of natural resources other than land.

### Discuss natural resources as an exchange option

**Exchange option**: to exchange one risky asset for another rather than to buy or sell one asset at a fixed exercise or strike price. The process of developing a resource involves using the mineral rights along with fuel, materials, labor, management, and equipment to bring a commodity to market: the developer exchanges one set of resources with stochastic prices (production inputs) to obtain the output (with a price also stochastic)

For example, firm with mineral rights to gold can be viewed as owning an option to exchange the mineral rights, fuel, mining equipment, labor, management, and materials necessary to extract the gold for a long position in the underlying gold.

### Discuss the concept of moneyness as it pertains to the development of natural resources

Moneyness reflects the direct benefit-to-cost ratio of developing the natural resource immediately. It has 3 status: in-the-money (>1), at-the-money (=1), and out-of-money (<1). Being in the money means that if the mineral rights are mined at the current price of commodity (i.e. gold), then revenues from sale of commodity will exceed the current costs of developing commodity (i.e. mineral rights, fuel, labor, management, materials, and equipment)

Perpetual option: option with no expiration date. The option to develop rights to a natural resource may have no expiration date.

### Discuss why some in-the-money options should not be immediately exercised

The value of delaying a decision to exercise an ITM development option is based on an analysis of benefit of awaiting further information.

### Describe the relationship between the moneyness of natural resource options and short-term financial risks

The short term financial risks are primarily driven by the price of the underlying commodity. The steep slope of deep ITM option indicates that changes in the price of commodity are the dominant source of short-term volatility in the value of option to develop the natural resource.

Higher moneyness shortens the time horizon of the exercise of the option and reduces the chance that the option’s price will be substantially altered directly by changes in the cost of developing the natural resource.

## Demonstrate knowledge of land as an alternative asset.

### Define land banking

**Land banking**: investment in and acquisition of undeveloped land or vacant lots. It is the practice of buying vacant lots for the purpose of development or disposition at a future date.

### Describe the three types of land lots (i.e., paper lots, blue top lots, and finished lots)

1. **Paper lots**: sites are vacant and approved for development by local zoning authority, but for which construction on streets, utilities, and other infrastructure has not yet commenced.

2. **Blue top lots**: interim stage of lot completion. Owner has completed rough grading of property and lots has paid all applicable fees required. At his stage, a home builder can obtain a building permit upon payment of ordinary building permit fee.

3. **Finished lots**: fully completed and ready for home construction and occupancy. All entitlements, including infrastructure to the lot, finished grading, streets, common area improvements, and landscaping, have been completed. All development fees have been paid.

### Discuss investment in undeveloped land as a call option

1. The **strike** is the cost of developing or improving the land (e.g. constructing an apartment building)

2. The **time** **to** **expiry** is typically unlimited.

3. The **receivable** **asset** of the option is the combination of land and its improvement or development (e.g. finished apartment building with the land beneath it)

4. The **payoff** of option is spread between the value of completed project and the cost of constructing the project

**Note**: the strike price tends to be correlated with the price of imported real estate, because the actions of developers tend to arbitrage the relative prices whenever the price of improved real estate substantially increases relative to the cost of development.

### Apply the binomial option pricing technique for valuing land as a call option

A **risk-neutral probability** is a probability that values assets correctly, if all market participants were risk neutral.

### Describe the risks and returns of investing in land

Land development tends to be riskier and more speculative than other real estate investing, owning primarily to its lack of revenue, its long holding period, and its uncertain prospects.

### Calculate the expected return of land investments

The expected return depends on its systematic risk, which is the probability-weighted average of expected return of land if it is developed

Undeveloped land is criticized as an investment with poor returns, based on observation that values of undeveloped land do not increase substantially over time. <- however, historical returns of undeveloped land may suffer from a **negative** **survivorship** **basis**, which is a downward bias caused by excluding the positive returns of properties or other assets that successfully left the database.

Negative survivorship bias = = mean return - undeveloped land return

## Demonstrate knowledge of timber and timberland as alternative assets.

### Discuss the characteristics of timber and timberland

**Timer** is investment in existing forestland for long-term harvesting of wood. Forests may be owned by the

1. **Public ownership (86%)**: government body exercises ownership jurisdiction over lands

2. **Private ownership**: individuals, firs, business, corporations, and non-governmental organizations possess ownership rights to forests

Note: United States is different, as 57% are privately owned, and 43% are publicly owned

### Discuss the role of timberland investment management organizations (TIMOs)

**TIMO** (Timberland Investment Management Organization): provide management services to timberland owned by institutional investors, such as pension plans, endowments, foundations, and insurance companies. Instead of actually owning the timberland, TIMO arranges for investors to buy the timberland and then manage the timberland on behalf of those investor

### Describe the risks and returns of timberland investments

Pros and cons of Timber investment

**Pros**:

1. Timber can be an inflation hedge

2. (key) Timber has had modest correlation to stocks and bonds

3. Timber is also an investment in land

4. Timer is perpetually renewable resource

5. The harvest schedule for timber is very flexible

6. Three continue to grow until harvesting

**Cons**:

1. Timer values are tied to cyclical industries

2. As a renewable resource, timber supply is not fixed

3. Electronic media and recycling limit demand for paper

4. Timber is at risk to natural disasters

**Rotation**: length of time from the start of timber (planting) until the harvest of the timber.

### Identify methods of timberland ownership

There are 2 publicly traded ways to invest in timber

1. At least 2 ETFs have been developed to track S&P Timber and Forestry index. Unfortunately, the returns of two ETFs have not matched those of index very closely

2. Through real estate investment trusts (REITs). There are four REITs that specially invest in timberland

## Demonstrate knowledge of farmland as an alternative asset.

### Discuss the characteristics of farmland investments

**Farmland** represents ownership of a real asset (land), and also generates current cash flow, as crop income is a potentially steady and renewable stream of cash. The difference: the annual cash flow is more closely linked to commodity prices (i.e. crop prices) rather than rent. Therefore, the farmland market rice is closely linked to commodity prices.

The owner of farmland can lease the land to a local farmer, a cooperative, or even an agricultural corporation. Hence, the lease payments are made on a calendar basis.

Farmland vs timberland: farm crops must be harvested annually and generally within a window of just a few weeks, while timberland has great flexibility in harvest schedule.

Farmland faces political risk, economic uncertainty caused by changes in government policy that may affect returns, perhaps dramatically.

### Calculate the value of farmland based on annual operating income and the cap rate

Value of real estate = annual operating income / cap rate

Cap rate: capitalization rate (or yield) = return on assets

### Discuss factors that affect farmland prices and returns

Total returns on farmland depend on cash flows from income as well as changes in market prices of farmland. Farmland contains the idiosyncratic risks of poor harvests and farm-specific cost inefficiencies. Farmland revenues, returns, and valuations are also driven by macroeconomic factors, including commodity prices.

**Two potential boosts to farmland prices:**

1. Farmland may be viewed as a play on the growing global population

2. Continuing expansion in farmland as a source of energy through bio-fuels.

The expected **returns** of farmland:

1. Farmland produces commodities that trade on international markets

2. Unlike buildings, farmland generally does not deteriorate substantially through time and does not need renovation

3. Farmland is very scalable: the additional amount of machinery and labor needed to manage and produce crops on additional acreage is not large

There are **risks** to farmland from a portfolio management perspective:

1. Farmland is illiquid like most other forms of real estate investing

2. Transaction costs are high (fees of 3% to 5%)

3. The time to find a suitable buyer can be long, particularly in a recession

4. Financing can become unavailable at times, which can undermine the land value

### Describe farmland as a multiple use option

The value of multiple purposes of farmland is driven by 3 factors

1. Current closeness of profitability of each alternative to each other: see the value of each

2. The volatility of probability of each alternative

3. The lack of correlation between alternatives as to profitability: low correlation of uses generates higher option value

### Identify methods of obtaining exposure to farmland

Private farmland ownership is the primary method. For publicly traded alternatives, there are 2 stocks that track farmland and agribusiness industry: DAX Global Agribusiness Index and Thomson-Reuters In-the-Ground Global Agriculture Equity Index. Both track publicly traded companies that engage in 4 areas of agribusiness industry

1. Agricultural products

2. Seed and fertilizer

3. Farm machinery

4. Packaged foods

## Demonstrate knowledge of valuation and volatility of real assets.

### Discuss the smoothing of prices and returns

Real assets often do not have observable market values and instead are valued by appraisals.

**Smoothing**: reduction in the reported dispersion in a price or return series

### Determine the effect of smoothing on observed volatility

If the highest and lowest returns are smoothed, the observed volatility can be substantially reduced. Smoothing can also affects the measured correlation between returns on different assets.

That is return series changes, can cause change in correlation and volatility

### Describe how values and returns are managed

**Managed returns** are returns based on value that are reported with an element of managerial discretion. There are 4 primary ways that values and returns can be managed

1. **Favorable marks**: indication of value of a position that is intentionally provided by a subjective source. e.g. ask brokerage to provide indication of higher values for reporting. Favorable marks may be used to obtain high real estate appraisals that enable larger mortgages.

2. **Selective appraisals**: opportunity for investment managers to choose how many, and which, illiquid assets should have their values appraised during a given period. This practice enables investment managers to alter the timing of appraisals and selection of properties to be appraised to manager reported returns.

3. **Model manipulation**: the process of altering model assumptions and inputs to generate desired values and returns. it can happen in commix unlisted derivative transactions. The reported value can be manipulated by altering the parameter values that are inserted into the model.

4. **Market manipulation**: engaging in trading activity designed to cause the markets to produce favorable prices for thinly traded listed securities. e.g. a buy order placed very near the close of trading to generate a higher closing price in order to report more favorable returns for the current period.

### Discuss how appraisals contribute to smoothing of real asset prices

A central issue in the analysis of the risks and returns to real assets is the effect of the use of appraisals on the estimation of returns and the measurement of risk.

1. Anchoring: appraisers may inadvertently underprice real assets that experience large upward shifts and overprice real assets that experience large downward shifts. the result is a highly smoothed price.

2. Extreme illiquidity: period of months typically passes between the agreement on a price for a transaction and the actual culmination of the exchange. Thus, changes in appraised values typically lag changes in actual values by even more than changes in observed transaction prices do.

These 2 sources of lagged information affect the measurement of return correlations between liquid and illiquid assets. for example, the liquid and illiquid has the same return series, but illiquid asset has 1 period lag behind because of illiquidity lag and appraisal lag. the true correlation is 100%, but the true correlation may be 30%

### Compare smoothed returns with market returns

Often the returns from appraised values diverge substantially from the returns computed from market prices, even though the underlying real assets are similar. In particular, the volatility of returns based on market prices is often substantially higher than the volatility of returns based on appraised values.

**Contagion**: any tendency of major market movements to be transmitted from one financial market to other financial markets. The high volatility of listed real estate prices would be driven by potentially temporary contagion effects rather than indicating true volatility in the value of underlying properties.

## Demonstrate knowledge of historical performance of timber and farmland.

### Recognize inferences that can be drawn from comparing definable characteristics of timber and farmland investing with their historical stand-alone and portfolio performance

the total measured risk of both timber and farmland was much **lower** than risk of equities, commodities, and high-yield bonds, and was in line with that of global bonds.

Smoothing has minimal effects on long-term average reported returns but tends to cause substantial underestimation of volatilities and extreme deviations in true returns.

# Chapter 11 Commodity Forward Pricing

## Demonstrate knowledge of forward and futures contracts.

### Describe the trading differences between forward and futures contracts

1. Forward contracts are typically OTC while futures are exchange traded

2. Forwards are ad hoc contracts negotiated between two parties, with flexibility regarding the details to help meet the needs and preferences of each party. Futures contracts are standardized.

3. The standardization of futures contracts permits active trading and liquidity

### Describe and apply the marking-to-market process for futures positions

A critical distinction between futures and forward contracts is that futures are marked to market, which means the side of a futures contract the benefits from a price change received cash from the outside of the contract throughout the contract life.

### Discuss the effect of marking-to-market on counterparty risk

**Crisis at maturity:** when party owing a payment is forced at the last moment to reveal that it cannot afford to make the payment.

Daily marking of a position to market typically limits counterparty risk to one day’s price movement. As an OTC traded product, forward contracts are not usually marked-to-market and are therefore subject to greater counterpart risk.

### Recognize the effect of marking-to-market and the time value of money on risk and prices

A critical difference between forwards and futures is that MtM of futures accelerates the receipt of profits and losses relative to forward contracts.

1. Acceleration of cash flows: higher price volatility and higher risk.

2. Increase the present value by paying now. So futures have higher price risk than otherwise identical forward contracts.

At inception, no difference between the price of a futures contract and an otherwise identical forward contact if interest rate changes are uncorrelated with the spot price underlying the contract. However, with positive correlation between spot prices and interest rates, the long side of futures contract tends to receive MtM cash flows when interest rates move higher and tends to deliver MtM cash flows when interest rates move lower. This asymmetric relationship, which tends to benefit the long side, forces the price of the futures contract above the price of an otherwise equivalent forward contract.

I.e. forward value vs futures value <= depends on correlation between spot price and interest rates

### Define and calculate initial margin for futures positions

**Initial margin**: the collateral deposit made at the initiation of a long or short futures position. Margin is set by exchange and subject to change (usually <10%).

### Define and calculate maintenance margin for futures positions

**Maintenance margin** requirement is a minimum collateral requirement imposed on an ongoing basis until a position is closed. It is usually set to be 75% to 80% of IM. If the collateral of a market participant falls below the maintenance margin requirement due to MtM losses, a margin call is issued.

A **margin call** is a demand for posting of additional collateral to meet the initial margin requirement. If investor cannot meet margin call, the futures commission merchant has the right to liquidate the investor’s positions in account. This daily process ensures to reduce counterparty risk.

## Demonstrate knowledge of the rolling futures positions.

### Explain the process of maintaining long-term futures exposures through short-term futures positions

As futures and forwards expire at settlement, it is necessary to roll the positions over at or prior to their settlement dates to maintain a long-term exposure. **Rolling** **contracts** refers to the process of closing positions in short-term futures contracts and simultaneously replacing the exposure by establishing similar positions with longer terms.

**Front month contract** (front contract, nearby contract, or spot contract): futures contact with shortest time to settlement

**Distant contract** (deferred contract, or back contract): contract with longer times t settlement

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### Discuss the effects of rollover decisions on the returns of long-term futures exposures

The timing of each rollover transaction is at the discretion of the investor. The critical point is: long-term returns on futures contracts vary based on the particular decisions made by the holder of the position regarding the procedures used to extend the position into a longer position. Traders with different preferences for rolling contracts experiences different long-term returns.

## Demonstrate knowledge of the term structure of forward prices on commodities.

### Recognize the cost-of-carry model for commodity futures contracts

Cost of acquiring and carrying a long position in underlying physical commodity:

Spot commodity price + carrying costs = forward price

Real Assets Financial Assets

Benefits Convenience (y) Dividends and coupons (d)

Costs Interest (r) + storage (c) Interest (r) + custody (zero)

**Cost** **of carry**: the benefits of carry, and assigned a negative value.

**Storage** **cost**: expenditures such as warehouse fees, insurance, transportation, and spoilage.

**Convenience** **yield** is the economic benefit that the holder of an inventory in the commodity receives from directly holding the inventory rather than having a long position in a forward contract on the commodity.

### Recognize and calculate arbitrage-free forward pricing for physical assets

### Recognize limitations to arbitrage-free forward pricing for physical assets

1. Short position in underlying physical asset may be very difficult for expensive to obtain

2. Convenience yields and storage costs of market participants may differ and are unobservable

For potential inability to take a cost-effective short position in physical asset

Reason for inequality: long positions in the spot price can be used to perform arbitrage when he forward price is too hight, but short positions in the spot price may not be available to perform arbitrage when forward price is too low.

### Discuss the effect of harvests, supply elasticity, and shifts in supply and demand on the term structure of forward prices

A key issue in understanding the term structure of forward prices is the rate at which and extent to which the supply and demand of a commodity can change.

**Inelastic supply**: supplies change slowly in response to market prices

**Perfectly elastic supply**: any quantity demanded of a commodity can be instantaneously and limitlessly supplied without changes in the market price (e.g. currency).

## Demonstrate knowledge of the concepts of backwardation, normal backwardation, contango, and normal contango.

### Define and compare backwardated markets and markets in contango

1. Backwardation: forward price < current spot price

2. Contango: forward price > current spot price

### Discuss backwardation and contango in informationally efficient markets

In informationally efficient market, contango and backwardation occur to prevent arbitrage opportunities.

In efficient market, all contracts offer equal risk-adjusted expected returns, regardless of the slope and shape of term structure of forward prices.

### Define and compare normal backwardation and normal contango

1. Normal backwardation: the forward price is believed to be below the expected spot price. It does not mean the markets are inefficient.

2. Similar for normal contango

Unlike backwardation and contango, normal backwardation and normal contango cannot be directly observed, because expected spot prices cannot be observed.

### Discuss normal backwardation and normal contango in informationally efficient and inefficient markets

The only time that forward = spot price in an informationally efficient market is when underlying asset contains no systematic risk.

## Demonstrate knowledge of the characteristics of returns on futures and forward contracts.

### Discuss futures and forward contracts as alpha and beta drivers

**Alpha** **driver**: a market participant who uses futures contracts or forward contracts might be viewing the forward contracts on a commodity as misplaced relative to the underlying spot price or to other vehicles for obtaining commodity exposure.

**Beta** **driver**: try to obtain the risk and returns of the underlying commodity in most cost-effective manner possible. e.g. portfolio manager wish to diversify into Japanese equities may establish a position in a forward contact on Nikkei 225.

### Define the law of one price

The **law of one price** states that in the absence of trading restrictions, two identical assets will not persist in trading at different prices in different markets because arbitrageurs will buy the relatively underpriced asset and set the relatively overpriced asset until the discrepancy disappears.

### Describe the relationship between ex ante alpha and the shape of the term structure of forward prices

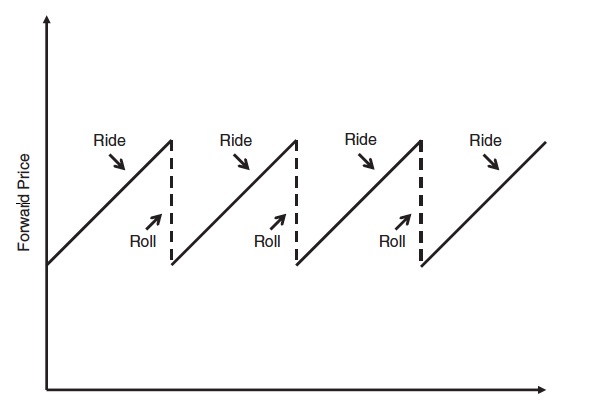
Alpha-driven strategy example: use futures or forward based on shape of term structure of forward prices.

Ex ante alpha exists when the term structure of forward prices takes on a shape that is informationally inefficient.

An **informationally inefficient term structure**: has pricing relationships that do not properly reflect available information

Ex ante alpha generation requires knowledge of when the shape of term structure is informationally inefficient and therefore out of equilibrium and able to arbitraged. The primary method of generating alpha is understanding equilibrium pricing and anticipating the forces that ultimately guide prices toward their informationally efficient levels.

### Discuss informationally inefficient term structures of forward curves



### Define and determine the basis of forward contracts

The **basis** in forward contract is the difference between spot (or cash) price of the referenced asset, S and the price (F) of a forward contract with delivery T

Basis =

In informationally efficient market, basis = cost of carry

### Describe calendar spreads, and discuss their risks and returns

Calendar spread

A **calendar spread** can be viewed as the difference between futures or forward prices on the same underlying asset but with different settlement dates. Therefore, it is a speculation on changes in the shape and slope of term structure of forward prices.

### Calculate returns to calendar spread positions

The return depends on spot price (S), riskless rate (r), and storage cost (c) and convenience yield (y)

1. If , the return on calendar spread did not depend on level of spot price. for example, the spot price increase $1, there is no P/L, as both forward prices equal to spot price. the trader is hedged against spot prices.

2. , the forward prices will rise relative to spot prices. The longer delivery date of long position will cause the forward price to rise in price more than the shorter forward, netting the trader a profit.

Return on calendar spreads are primarily driven by 2 equivalent concepts

1. Changes in the slope of the term structure of forward prices

2. Changes in carrying costs

# Chapter 12 Commodities: Applications and Evidence

## Demonstrate knowledge of the diversification benefits of commodities.

### Explain the sources of potential diversification benefits offered by commodities

There are 4 arguments to support low or negative correlation between commodity prices and returns to financial assets:

1. Unlike financial securities, commodities have prices that are not directly determined by the discounted value of future cash flows. Instead, commodity prices are evaluated primarily on forecasts of the commodity’s supply and demand.

2. Nominal commodity prices should be positively correlated with inflation largely because commodity prices form part of definition and computation of inflation.

3. Negatively correlated with the returns of stocks and bonds: they may react very differently at different parts of the business cycle. Note: commodity is often priced more on the state of current economic conditions and factors regarding short-term supply and demand.

4. Commodities are a major cost of some corporate producers. Thus, as commodity prices soar, the corporate stocks and bonds may falter (become bad).

### Discuss commodities in the context of equilibrium diversification

Diversification is the process of eliminating exposures to idiosyncratic risks while constructing a portfolio that matches the risk characteristics of a perfectly diversified portfolio.

### Discuss how market imperfections relate to determining allocations to commodities

It is no longer clear that all market participants should include commodity in their portfolios with a weight equal to the market weight of that commodity.

### Discuss commodities as a diversifier of inflation risk

Commodity investment is able to diversify a portfolio against the risk of unexpected inflation. Real assets in general and commodities in particular offer protection against inflation risk, which is defined to be the dispersion in economic outcomes caused by uncertainty regarding eh value of a currency.

There are 2 intuitive explanations for the protection from inflation risk provided by commodities

1. commodity prices are an important determinant of the price indices that measure infaltion

2. the value of commodity is its perceived ability to provide consumption.

## Demonstrate knowledge of commodities as potential return enhancers

### Discuss potential return enhancement from idiosyncratic returns

Commodity alpha is to speculate on idiosyncratic movements in the underlying commodity prices. Investors use technical and fundamental analysis to forecast commodity prices and to identify trades with superior risk-adjusted returns.

### Discuss potential return enhancement from systematic returns in efficient markets

Commodity do not enhance expected returns when they are efficiently priced and when their systematic risk exposures (beta) are low. If markets are perfect and in equilibrium, market participants should hold exposures to commodities and other asset classes based on market weights, expecting lower returns in exchange for enjoying lower risk. Thus, return enhancement from beta must be attributable to market inefficiencies or markets in disequilibrium.

### Discuss potential return enhancement from systematic returns in inefficient markets

In disequilibrium, participants tend to hold substantially different exposures to various asset classes - especially commodities-than exposures based on market weights.

### Discuss potential return enhancement from providing insurance through commodity futures

Insurance companies strive to earn profits through providing protection to their customers against risks in exchange for insurance premiums.

## Demonstrate knowledge of investing in commodities without futures.

### Recognize characteristics of physical ownership of commodities

**Convenience yield**: marginal economic benefit that an investor obtains for having physical ownership of a commodity rather than synthetic ownership through futures contracts or other financial securities.

Physical ownership of commodities offers the benefit of convenience yield but also the costs of storage and transportation. Poor method of commodity exposure for investors without competitive advantage to storing commodity and without high convenience yield

### Recognize investments in commodities through related equity instruments

**Method**: hold stocks of natural resource company

**Problem**: firms have revenues related to a variety of commodities. As such, share price of most firms will often be poorly correlated with the price of single commodity

1. High correlation between stock price and commodity price assumes that firms has not hedged its exposure to commodity through short positions in forward or futures contracts

2. Though EPS may be highly correlated with underlying commodity prices, P/E ratio may not be.

3. Firm’s financial and operating leverage may vary and affect the returns of investment in a way that is uncorrelated with the commodity price

### Recognize investments in commodities through exchange-traded funds (ETFs)

There are several structures through which commodity ETFs can obtain exposure to commodity prices:

1. **Futures** markets

2. **Equity** markets

3. **Physical** **ownership**

Most ETFs tend to be cost-effective for retail investors, but may not be adequately cost-effective for institutional-sized portfolios

**Exchange-traded notes** (ETNs): ETFs have a direct claim on underlying pooled portfolio, while ETNS purchase a debt security with cash flows directly linked to the portfolio.

ETNs incur credit risk of issuing bank, while ETF do not

Both ETNs and ETFs can have underlying commodity exposures diversified across energy, metals, and agricultural commodities.

### Recognize investments in commodities through commodity-linked notes (CLN)

**CLN**: intermediate-term debt instrument whose value at maturity is a function of value of underlying commodity or basket of commodities.

CLN advantages to investors

1. investor not have to execute the rolling of commodity futures contracts to maintain exposures

2. CLN is a debt instrument. they are recorded as debt instruments on B/S.

### Apply option valuation methods to price commodity-linked notes

## Demonstrate knowledge of commodity investment through futures contracts.

### Recognize the basis risk and investments in commodities through futures contracts

**Basis risk** is the dispersion in economic returns associated with changes in relationship between spot prices and future prices

A **fully collateralized position** is a position in which the cash necessary to settle the contract has been posted in the form of short-term, riskless bonds. The total returns from fully collateralized futures or forward returns differ from returns on spot positions on the same asset primarily due to basis risk. There are 3 sources of basis risk that causes realized returns on fully collateralized commodity futures contract or forward contract to differ from the total return on underlying spot position.

1. When the cost of carry to a marginal investor for the spot position are not the same as the costs implied by the basis. This indicate informational market inefficiency in pricing futures contract

2. When the convenience yield from the spot position differs from its storage costs

3. When the basis changes

### Recognize the components of returns to futures positions (i.e., spot return, roll yield, collateral yield, and excess return)

The return on a fully collateralized position, can be expressed a sum of two components:

= Collateral Yield + Excess Return

or three components

= Spot return + collateral yield + roll yield

1. **Spot** **return**: the return on underlying asset in the spot market. The returns of unhedged futures positions are primarily driven by spot return

2. **Collateral** **yield**: interest earned from riskless bonds or other money market assets used to collateralize the futures contract. Note: positions in futures contracts are often partially collateralized in that they only post collateral equal to margin required by futures exchanges. Partial collateral creates leverage

3. **Roll** **yield** / **roll** **return** / changes in basis: portion of return of a futures position from change in contract’s basis through time. Basis changes for 2 reasons: 1) time to settle futures shortens, and forward prices roll toward spot price; 2) components of cost of carry vary

### Describe the two interpretations of rolling contracts

Rolling has 2 interpretations:

1. Switch, or roll from a short term futures contract to a futures contact with a longer term to settlement in the process of maintaining a continuous exposure to the underlying asset. It’s viewed as holding a futures position, and the roll return is viewed as change in contract’s basis through time. This view tends to be associated with a financial economics view of risk and return.

2. The price rolls up the term structure of forward prices as its time to settlement nears. The rolling is viewed as a transaction, then roll return is viewed as P/L. This view is used to adjust excess futures returns in the process of reporting returns of continuous commodity exposures.

### Relate roll yield to the slope of the forward curve

when the market is in backwardation, holing a long position in futures contract tends to be successful strategy, as it earns roll return (or roll yield).

In an informationally efficient market, roll return is simply the change in basis that allows identical exposures in cash and futures markets to offer identical total returns.

### Discuss convergence and the relationship between futures and spot prices through time

**Convergence at settlement** is the process of futures price nearing the spot price as settlement approaches, and the two prices matching each other at settlement.

### Calculate the aggregated profit or loss for a futures position

Long a financial asset with spot price S\_0 and short position in corresponding one-year futures contract held to settlement initiated at forward price F(T)

P/L = F(T) - S\_0 - carrying cost

where the carrying cost = all benefits (dividends and convenience yield) of holding underlying - all costs (financing and storage costs) of holding.

In perfect market, financial futures contracts are all priced efficiently and all traders receive the same risk-adjusted returns, since they observe the same dividend yields and riskless rates.

### Recognize rollover strategies and their effect on returns from futures investments

There are 3 ways of expressing the relationship between spot and forward prices through time

1. Basis

2. Carrying cost

3. Roll yield

All these 3 terms express the same concept

### Recognize the three propositions regarding roll return

The more common definition of roll return (roll yield) is that it is return accused in a futures contract through time, attributable to changes in basis of futures contract.

Proposition 1: roll return is not generated when one position is closed and a new position is opened. E.g. roll return is not generated by closing short-term futures and open a long-term contract for $3 profit. Roll return occurs throughout the time that a particular futures or forward contract is held. The price difference is based on the same contract at two different points in time

Proposition 2: roll return is not necessarily positive when markets are backwardated. If cost of carry no change, then roll return is positive. If cost of carry changes, then no guaranteed positive return

Proposition 3: A position generated a positive roll return does not indicate the position’s total returns are superior (i.e. there was alpha). Roll return is usually negative, to punish the forward position for not requiring a cash investment relative to spot position.

## Demonstrate knowledge of commodity indices.

### Discuss the process of construction of commodity futures indices

Returns on physical commodities are generally better measured using prices of futures contracts rather than spot or cash prices. Because spot prices of physical commodities are not generally traded in a single centralized market, spot prices vary between locations. In addition, some commodities have different qualities or grades that trade at different prices.

1. Commodity futures indices are generally constructed to be unleveraged

2. The face value of futures contracts is fully supported (collateralized) either by cash or by riskless bonds (e.g. treasury bills)

An investment manager can use commodity futures indices in several ways

1. As a benchmark for investment performance

2. Implement an active tactical bet that underlying commodities will generate superior expected or average returns

3. A passive strategy of providing reduced risk through portfolio diversifications

### Discuss the characteristics of commodity indices given by S&P GSCI, BCOM, and CRB

1. **S&P** **GSCI**: S&P Goldman Sachs Commodity Index, production-weighted index (quantity-weighted). 70% in energy, and constructed with 24 physical commodities across 5 main groups of real assets: precious metals, industrial metals, livestock, agriculture, and energy

2. **BCOM**: Bloomberg Commodity Index, on 22 physical commodities, diversified and include petroleum products, natural gas, precious metals, industrial metals, grains, livestock, soybean oil, coffee, cotton, cocoa, and sugar.

3. **CRB**: Reuters/Jefferies Commodity Research Bureau, 19 commodities traded on various exchange. It included 4 tiers grouping system to weight the commodities.

## Demonstrate knowledge of risks associated with commodity investments.

### Discuss the effect of event risk on returns from investments in commodities

There are 4 char of commodity investments that many major events actually enhance returns to investors with long positions in commodities

1. Most major global **events** cause **increases** in commodity **prices** due to anticipated decreases in commodity supplies or increases in demand.

2. Commodity price increases due to events tend to be larger and more sudden than the price decreases resulting from events that lower commodity prices => positively skewed return for long positions in commodities

3. Many commodity shocks are likely to be uncorrelated with each other

4. Shocks to commodities markets are generally uncorrelated with shocks to financial markets

### Discuss the role of commodities as defensive investments

Most traditional investments do not offer both protections from global turmoil and attractive returns. This is why investors are drawn to alternative investing.

### Discuss acceptance of commodity investments by institutional investors

Institutional investment capital committed to commodity futures is considerably **smaller** than that invested with hedge funds. **Reasons:**

1. Lack of understanding of commodities as investment products

2. Perception that commodity futures are extremely risky investments

## Demonstrate knowledge of the return characteristics of commodity investments.

### Recognize inferences that can be drawn from comparing definable characteristics of commodities with their historical investment performance

1. Average annual commodity returns was somewhat lower than the average annual returns of equities, bonds and US high-yield bonds.

2. Commodities exhibited substantially higher return volatility than equities

3. Negative sore and high kurtosis

4. Lower sharp ratio

# Chapter 13: Operationally Intensive Real Assets

## Demonstrate knowledge of commodity producers.

### Describe how commodity prices affect operating performance of firms that transform natural resources into commodities

Moderately correlated with the price changes of their products. E.g. Gold firm vs gold price

There are sound economic reasons to believe that market prices of firms related to extraction and processing of natural resources should be substantially correlated with natural resources prices. **Reason**: increase in commodity price indicate that demand vastly exceeded supply at previous price.

In theory, the correlations between returns of first and price changes for their associated goods are driven by 3 primary factors

1. Price elasticity of demand for good

2. Price elasticity of supply of good

3. Extent to which an operating firm is exposed to or has hedged changes in its profits

* Describe the relationship between commodity prices and equity prices of commodity producing firms

Operationally intensive firms related to a commodity have short- and long-term performance that differs substantially from the price performance of related commodity.

Equity price of firm depend only partially on commodity price

* Discuss the empirical evidence on the correlation between commodity prices and equity prices of commodity-producing firms

Not purely correlated (\rho ~=70%). Rather than returns of firms being driven entirely by contemporaneous prices of related commodities, they are presumably also driven by the market’s anticipation of dynamic supply and demand factors more related to long-term profitability of goods and services directly offered by those firms.

## Demonstrate knowledge of liquid alternative real assets.

### Discuss the structure of master limited partnerships (MLPs) and characteristics of the MLP sector

Limited partnerships where ownership is publicly traded. MLP stellar these years, and traded in NYSE, the same manner as corporate operating firms. MLPs are not shared in equity of taxable corporations, they are are limited partnership units representing direct ownership of a firm.

Most MLP are involved in energy sector. The oil and gas sector is divided into upstream (exploration and production), midstream (storing and transporting) and downstream (refining, distributing, and marketing) operations.

### Identify the tax characteristics of MLPs

Limited partnerships in general and MLPs in particular are not directly subject to income taxes at partnership level. The revenues, expenses and profits of partnerships flow directly through the partnerships and into the tax forms of the partners.

Corporate Income tax? Individual Income Tax?

C corporation Yes Yes

Investment Company No Yes

Limited partnership No No

The potential tax benefits of MLPs to US investors subject to 3 potential drawbacks

1. MLPs report income on K-1 forms rather than 1099s, which may add substantial complexities and delays to federal tax filing

2. MLP income is usually subject to income taxation in the states in which MLPs operate. I.e. subject to state income tax

3. MLP can cause unrelated business income tax for some pension plans and not-for-profit corporations in US

### Discuss valuation of MLPs

MLP investors are taxed on income, not distributions from MLPs. MLP structures themselves are not required to pay income taxes. MLPs are free to make distributions as high as their cash flows allow.

The controversy over MLP distribution rates (vary a lot) relate to two valuation theories

1. PVGO (PV of Growth Opportunities) valuation theory: a high value assigned to an investment based on idea that the underlying assets offer exceptional future income. Thus, a growth stock might sell for a much higher value than s justified by its past and current income based on PVGO

2. Ponzi-like valuation theory (overpriced)

Overpriced and fraudulent operation in which cash inflows from new investors are distributed to old investors with false description that they emanate from current and past success of underlying investments.

## Demonstrate knowledge of infrastructure as an alternative asset.

### Recognize the seven characteristics that distinguish investable infrastructure from other assets

If 7 elements are met, then an asset is more likely to be considered as investable infrastructure asset.

1. Public use: associated economic activity is accessed by a large segment of population or general welfare of a society

2. Monopolistic power: services are offered by a single provider or are offered such that provider can set prices relatively free from competition

3. Government related: underlying assets are typically crated by, owned by, managed by or heavily regulated by government

4. Essential: good or services, such as electricity distribution. It’s price inelastic, and cash inflows tends to be stable and inflation-protected

5. Cash generating: such as toll roads

6. Conducive to privatization of control: make underlying assets and systems relatively conducive to privatization of managerial control

7. Capital intensive with long-term horizons: capital intensive with underlying assets that are long-term in nature

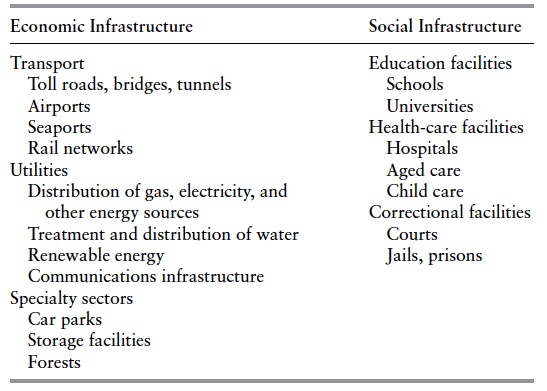
E.g. Municipal bond backed by revenues from toll road: NOT

Greenfield project: a new, yet-to-be-constructed investable infrastructure project

Brownfield project: existing project with a history of operations

### Contrast economic and social infrastructure

MN separate infrastructure investments into 2 broad categories of economic and social infrastructure



### Discuss the influence of government on infrastructure investments

Privatization: governmental entity sells a public asset to a private operator

Public-private partnership (PPP): private sector party is retained to design, build, operate, or maintain a public building, often for a lease payment for a respecified period of time.

1. The scope and quality of a nation’s infrastructure can influence its economic growth, with weaker infrastructure often blamed for reducing the economic growth potential of a nation.

2. Regulatory risk in a transaction, economic dispersion to an investor form uncertainty regarding government regulatory actions, including indication of project.

### Describe investment vehicles for investing in infrastructure

Listed stocks, listed funds, open-end funds and closed-end unlisted funds (or evergreen funds, which allow investors to subscribe to or redeem from these funds on a regular basis)

### Discuss the risks and rewards of infrastructure investments

The risk can be ordered by geography, type, age and the amount of development risk. the least risky infrastructure investments are mature assets with a long history of stable cash flows (e.g. brownfield investments in developed markets). The riskiest projects are Greenfield investments.

## Demonstrate knowledge of intellectual property as an alternative asset.

### Discuss intellectual property as an investment

Intangible assets are economic resources that do not have a physical form, including ideas, technologies, reputations, artistic creations.

**Intellectual** **property** (IP): intangible asset that can be owned, such as copyrighted artwork, which should be excludable.

**Excludable** **good**: good others can be prevented from enjoying

### Describe characteristics of intellectual property

Unbundled IP may be acquired or financed at various stages in its development and exploitation.

1. Newly created IP may have widely varying value and use. Exploratory research, new film production, new music production, pending patents, and the like typically have widely uncertain value prior to production or implementation.

2. Mature IP typically has more certain value and more certain ability to generate licensing, royalties, or other income than do early-stage projects.

### Recognize the factors that contribute to returns of film projects

Film production and distribution is a major business and it offers perhaps the best data available on which to analyze historic risks and returns.

Film production itself has several stages. First, the costs of producing the film are collectively called negative costs, which refer not to the sign of the values but to the fact that these are costs required to produce what was, in the predigital era, the film’s negative image, including story rights acquisition; preproduction (script development, set design, casting, crew selection, costume design, location scouting); principal photography and production (compensation of actors, producers, directors, writers, sound stage, wardrobe, set construction); and postproduction (film editing, scoring, titles and credits, dubbing, special effects).

### Define and apply the simplified model for valuing intellectual property

Use discounted CF model:

Equivalent to perpetual growth model for common stocks except the use of P\times CF\_1 to denote the expected cash flow in the first year and the idea that g could be negative.

: required rate of return; : initial potential (negative for wasting); : probability of substantial success for an investment.

Another form: r =

The total return is expected cash flow in the first year expressed as a percentage of value of IP - rate of decay

# Chapter 14: Liquid and Fixed-Income Real Estate

## Demonstrate knowledge of real estate as an investment.

### List five common attributes of real estate that encourage its inclusion in investment portfolios

5 common attributes of real estate to include in an investment portfolio

1. Potential to offer absolute returns

2. Potential to hedge against unexpected inflation

3. Potential to provide diversification with stocks and bonds

4. Potential to provide cash flows

5. Potential to provide income tax advantages

Note: the first 3 are related to portfolio risk, NOT without costs.

### Discuss heterogeneity, lumpiness, and illiquidity of real estate

There are 3 potential disadvantages:

1. Heterogeneity

Physical features of individual properties unique in terms of location, use and design, but varying lease structures can lead to large difference sin income streams.

2. Lumpiness

It describes when assets cannot be easily and inexpensively bought and sold in sizes or quantities that meet the preferences of buyers and sellers.

3. Illiquidity

### Discuss and contrast core, value-added, and opportunistic real estate investment styles

(NCREIF) styles of real estate investing refers to the categorization of real estate property char into core, value added, and opportunistic

1. Core properties are most bond-like, and opportunistic properties are most equity-like

2. Core real estate includes assets that achieve a relatively high percentage of their returns from income and are expected to have low volatility. It contains 5 specific categories: office, retail, industrial, multi-family, and hotels. It is the most liquid, most developed, least leveraged and most recognizable properties in a real estate portfolio.

3. Value added real estate includes assets that exhibit char: 1) achieving a substantial portion of their anticipated returns from appreciation in value; 2) exhibiting moderate volatility; 3) not having financial reliability of core properties.

4. Opportunistic real estate properties are expected to derive most tor all of their returns from property appreciation and may exhibit substantial volatility in value and returns.

## Demonstrate knowledge of residential mortgages in the context of alternative investments.

### Define mortgages, and differentiate between fixed- and variable-rate mortgages

A mortgage loan is defined as a loan secured by property. The property serves as collateral against the amount borrowed.

### Describe characteristics of fixed-rate mortgages, including amortization

A fixed rate constant payment, fully amortized loan has equal monthly payments throughout the life of the loan, which is subject to interest rate risk and inflation risk.

### Calculate monthly payments for fixed-rate and variable-rate mortgages

MP = MB\times{i/[1-(1+i)^{-n}]}

MP:Constant monthly payment; MB: mortgage balance or total amount borrowed; i is the monthly interest rate; and n is the number of months in term of loan.

or MP can be calculated using standard PV formula

### Describe characteristics of interest-only mortgages

The monthly payment consist entirely of interest payments for some initial period. e.g. first 10 year interest-only, followed by 20-year fully amortizing period. this is known as 10/20.

n=12\times15, i=6%/12; PV=100,000; FV=0, solve for PMT (monthly payment)

### Describe characteristics of variable-rate mortgages

variable-rate or adjustable-rate mortgage (ARM)

the monthly rate is adjustable each year. This variable rate, which applies for the whole next year, is based on some index rate.

ARMs typically includes a margin rate, which is the spread added to index rate.

### Describe other variations of mortgages

1. For variable rate mortgages, for initial interest rate to be low when compared to short term market rates and for that low rate to be fixed for an initial period. After this period, the mortgage rate is calculated based on lender’s standard variable interest rate

2. Graduated payment loan: initially fixed interest rate, relatively low, but scheduled to increase slowly over the first few years.

Both to help borrowers qualify for loan and able to make initial payments on the loan.

3. Payment flexibility: Option adjustable-rate mortgage (option ARM): adjustable-rate mortgage that provides borrowers with flexibility to make one of several possible payments on their mortgage every month. Feature: exacerbate default risk, and may not be fully amortizing.

4. Allow balloon payment. At the end of the loan, there is an outstanding principal amount due, equal to balloon payment.

Def: **Balloon** **payment**: a large scheduled future payment.

Def: **Negative** **amortization** occurs when interest owned is greater than the payments being made such that the deficit is added to the principal balance on the loan, causing the principal balance to increase through time.

### Calculate the monthly payments for a mortgage with a balloon payment

Same PV, int, but FV ~=0, with the remaining as balloon payment

### Describe default risk for residential mortgages

Default risk is dispersion in economic outcomes due to the actual or potential failure of a borrower to make scheduled payment

Loan-to-value of up to 95% are commonly allowed for insured residential mortgages

Residential mortgages with LTV ratios of 80% are often viewed as being very well collateralized.

## Demonstrate knowledge of commercial mortgages in the context of alternative investments.

### Describe characteristics of commercial mortgages

Commercial mortgage loans are loans backed by commercial real estate (e.g. multi-family apartments, hotels, offices, retail and industrial properties)

1. Loan term is almost always shorter than time required to fully amortizing the loan at required payments

2. Few individuals participate in this market as borrowers or lenders due to large size of commercial real estate projects

Important distinction when examine commercial mortgages: nature of the loan, whether for completed projects or for development purposes.

Development loans are shorter-term and phased, wherein the developer draws down funds only as required during the construction phase.

### Identify, describe, and apply financial ratios (i.e., loan-to-value ratio, interest coverage ratio, debt service coverage ratio, and fixed charges ratio) employed in the analysis of commercial mortgages

Residential mortgage are primarily concerned about interest rate risk and prepayment rates, commercial mortgage investors typically face substantial default risk related to credit risk of borrower, as well as the price risk of underlying collateral (i.e. property).

Covenants in commercial mortgage are more detailed than residential loans

In order to mitigate the risk, lenders commonly use a cross-collateral provision, wherein the collateral for one loan is used as collateral for another loan. E.g. corporation borrowed twice, securing each loan with a property. If corporation fully pays off one loan and wishes to sell the related property, the lender may prevent the sale as it’s still serving as collateral to the other loan.

Def: **Covenants**: promises made by borrower to lender, such as requirements that borrower maintain the property in good repairs and continue to meet specified financial conditions. Failure to meet the covenants can trigger default and make the full loan amount due.

As with residential loans, the LTV ratio, both at origination of the loan and on an ongoing basis, is a key measure used by lender.

Given that commercial real estate generates rental income, lenders also examine a variety of income-based measures when assessing credit risk of the loan.

1. Interest coverage ratio, defined as property’s net operating income / loan’s interest payments. Senior secured debt lenders usually require coverage ratio of 1.2 to 1.3. That is: projected net income must be at least 20% to 30% greater than projected interest payments.

2. Debt service coverage ratio (**DSCR**), defined as the ratio of property’s net operating income to all loan payments, including amortization of loan.

3. **Fixed** **charges** **ratio**, defied as the ratio of property s net operating income to all fixed charges that the borrower pays annually.

## Demonstrate knowledge of mortgage-backed securities.

### Discuss residential mortgages and their prepayment options

Residential mortgages are callable bonds. The lender is short a call option not he value of the loan, being short a put option on mortgage rates.

Unscheduled mortgage principal payments include full mortgage prepayments and partial repayments. The main issue: mortgage investor cannot predict the size of prepayments or the rate of unscheduled principal repayments received. Mortgage borrowers have an incentive to make unscheduled mortgage payments when the interest rates are low. Reasons:

1. Refinance when rates are low

2. Move and fully prepay mortgages

3. More likely to use excess cash to prepay mortgages

### Discuss and apply methods of measuring unscheduled prepayment rates

Mortgage returns not driven by default risk are primarily driven by interest rate risk inherent in prepayment risk.

Conditional prepayment rate (**CPR**): the annualized percentage of a mortgage’s remaining principal value that is prepaid in a particular month

Public securities association (**PSA**) established the PSA benchmark, standard approach used by market participants.

### Describe and apply conditional prepayment rates (CPRs) and the resulting Public Securities Association (PSA) benchmark

Expected cash flows cannot simply b discounted at expected interest rates, since larger cash flows (i.e. higher unscheduled principal repayment) tend to occur when interest rates are lowest. Thus, RMBS pricing models should be based on option pricing technology.

Def: **refinancing** **burnout**: reduced refinancing speeds due to high levels of precious refinancing activity.

### List prepayment factors not associated with changing interest rates

1. Idiosyncratic prepayment factors: personal circumstances (e.g. moving due t employment)

2. Systematic prepayment factor: a rise in economic activity or higher housing prices can great widespread prepayment path that mortgage rates have flooded to arrive at the current level refinancing burnout

3. Char of underlying mortgage pool, including maturities of mortgage, rates of fixed-rate mortgages, terms of an variable-rate mortgages, and geographic location of pool.

### Identify and describe commercial mortgage-backed securities, and compare and contrast them with residential mortgage-backed securities

Commercial mortgage-backed securities (CMBS) are mortgage-backed securities with underlying collateral pools of commercial property loans.

Compared to insured RMBS, a CMBS

1. Provides a lower degree of prepayment risk (often set for short-term, charge a prepayment penalty)

2. More subject to credit risk. default risk are complex and heterogeneous due to the unique risks of commercial real estate assets, including property type, location, borrower quality, tenant quality, else terms, property management, property seasoning, and year of origination.

3. Contain fewer loans, which shows concentrated risk to a relatively small number of potential defaults.

LTV ratio and debt yields (CF/$Loan) play a big role in analysis of CMBS issues.

## Demonstrate knowledge of real estate investment trusts (REITs).

### Define a real estate investment trust (REIT)

REIT is an entity structured much like a traditional operating corporation, except that the assets of entity are almost entirely real estate. Because most major REITs are listed on major stock exchanges, they are a simple and liquid way to bring real estate exposure into an investor’s portfolio.

1. Equity REITs invest predominantly in equity ownership within the private real estate market.

2. Mortgage REITs invest predominantly in real estate-based debt.

### List the key advantages of REITs

1. REIT provides management services in the selection and operation of properties

2. REIT provides liquid access to an illiquid asset classes

3. REITs avoid double taxation of income that comes with paying taxes at both corporate and individual levels. REITs avoid corporate income taxation to the extent that they distribute their income and capital gains to their shareholders.

### Discuss potential disadvantages of REITs as well as their main income restrictions

1. Management fees and lack of influence over management

2. Exchange-traded real estate investments (i.e. REITs) have greater price risk than private real estate investments, as market prices take on volatility of financial markets.

## Demonstrate knowledge of historical performance of mortgage REITs.

### Recognize inferences that can be drawn from comparing definable characteristics of mortgage REITs with their historical stand-alone and portfolio performance

1. US mortgage REITs enjoyed high average annualized returns compared to world equities, bonds and commodities. The total risk of mortgage REITs was much higher than bonds and somewhat higher than equities. The Sharpe ratio of mortgage REITs indicated comparable risk-adjusted performance to that of global bonds and US high-yield bonds.

2. Moderate correlations between mortgage REITs and both fixed income and equity indices, with little correlation with commodities

# Chapter 15: Real Estate Equity Investments

## Demonstrate knowledge of real estate development in the context of alternative investments

### Describe the processes of developing real estate

Real estate development projects can include one or more stages of creating or improving a real estate project, including acquisition of raw land, construction of imporovmeents, and renovation of existing facilities.

Real estate development entails

(1) acquiring land or a site;

(2) estimating the marketing potential and profitability of the development project;

(3) developing a building program and design;

(4) procuring the necessary public approvals and permits;

(5) raising the necessary financing;

(6) building the structure

(7) leasing, managing, and perhaps eventually selling the property.

* Describe the valuing of real estate development as a string of real options

Two key factors differentiate development projects from standing real estate investments.

1. Real estate development is a process in which a new asset is being created.

2. During the lifetime of the development, there is a high degree of uncertainty regarding the estimates of the revenues and costs of the investment

Def: A **real** **option** is an option on a real asset rather than a financial security. The real option may be a call option to purchase a real asset, a put option to sell a real asset, or an exchange option involving exchange of non-financial assets.

Each expenditure in the development process may be viewed as the purchase of a call option. For example,

(1) an initial feasibility analysis

may be viewed as the purchase of a call option on a call option (the second stage), which is in turn a call option on the final stage

(2) the purchase of a suitable tract of land

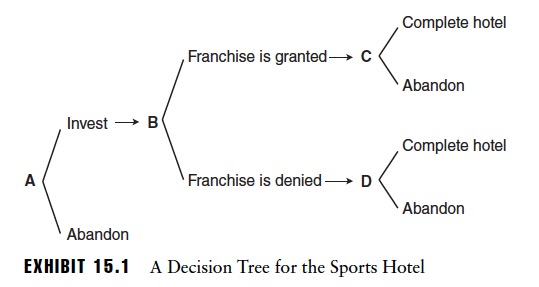
may be viewed as a call option in which the developer has the option to pay money to receive vacant land, which is itself an option on further development

(3) the construction of a building

may be viewed as a call option in which the developer has the option to pay money and contribute vacant land in exchange for an improved property

* Apply a decision tree and backward induction to value real estate development projects

A **decision** **tree** shows the various pathways that a decision maker can select as well as the points at which uncertainty is resolved.



**Backward** **induction**: used to solve a problem involving options and using a decision tree. It is the process of solving a decision tree by working from final nodes toward the first node, based on valuation analysis at each node.

## Demonstrate knowledge of valuation and risks of real estate equity

* Recognize and apply the discounted cash flow approach (i.e., income approach) to valuing real estate, including the calculation of net operating income and the discount rate

Def: **net sale process** (**NSP**) is the expected selling price - any expected selling expenses arising from sale of property at time T

Net operating income (**NOI**) is a measure of periodic earnings that is calculated as the property’s rental income - all expenses associated with maintaining and operating the property

NOI = Potential gross income - vacancy loss - fixed expenses - variable expenses

or NOI = effective gross income - operating expenses

Note: potential gross income: gross income that could potentially be received if all offices in the building were occupied.

Vacancy loss rate: observed or anticipated rate at which potential gross income is reduced for space that is not generating rental income.

Effective gross income = potential gross income - vacancy loss

For real estate investments, **risk premium approach** is used to estimate discount rate: using sum of a riskless interest rate and one or more expected rewards for bearing risks of investment: liquidity and risk. for example,

r = (1+R\_f)(1+E[R\_LP])(1+E[R\_RP]) - 1 ~= R\_f + E[R\_LP] + E[R\_RP]

R\_f: risk free rate, or US Treasury Note rates (e.g. 7-year)

R\_LP: liquidity premium

R\_RP: anticipated risk premium for systematic risk of real estate project

* Discuss the use of comparable sale prices for valuing real estate

For non-income-producing properties, DCF approach is not viable. However, comparable sale prices approach is not viable when the number of recent and relevant real estate transactions is very limited.

## Demonstrate knowledge of alternative real estate investment vehicles.

* Identify and describe private equity real estate funds

**Private equity** real estate funds are privately organized funds that are similar to other alternative investment funds, such as private equity funds and hedge funds, yet have real estate as their underlying asset.

The primary advantage to an investor is the access to private real estate. However, investments through private equity funds do not allow investors direct control over the real estate portfolio and its management.

There are 3 types of private equity real estate: commingled real estate funds, syndications, and joint ventures

* Identify and describe commingled real estate funds

**Commingled real estate funds** (**CREF**s) are a type of private equity real estate fund

that is a pool of investment capital raised from private placements that are commingled

to purchase commercial properties.

Usually CREFs are closed-end in structure, and share the same advantage and disadvantages as private equity real estate, except annual or quarterly appraisals of underlying properties.

* Identify and describe syndications

**Syndication**s are private equity real estate funds formed by a group of investors who retain a real estate expert with the intention of undertaking a particular real estate project

Syndicators profit from both the fees they collect for their services and the interest they may preserve in the syndicated property

* Identify and describe joint ventures

**Real estate joint venture**s are private equity real estate funds that consist of the combination of two or more parties, typically represented by a small number of individual or institutional investors, embarking on a business enterprise such as the development of real estate properties

* Describe limited partnerships, and apply the concepts of gearing and loan-to-value (LTV) ratios

Private equity real estate funds, including the three types described in the previous sections, are increasingly organized as limited partnerships

Gearing is the use of leverage. The degree of gearing can be expressed using a variety of ratios. It’s commonly expressed as debt / equity

**LTV ratio** (or debt-to-asset ratio) = fund’s capital financed by debt / all long-term financing (e.g. equity + debt).

* Identify and describe open-end real estate mutual funds

**Open-end real estate mutual funds** are public investments that offer a non-exchange-traded means of obtaining access to the private real estate market

Open-end funds initially raise money by selling shares of the funds to the public and generally continue to sell shares to the public when requested. However, these funds may limit investors’ ability to redeem units and exit the fund when, for example, a significant percentage of shareholders wish to redeem their investments and the fund is encountering liquidity problems

Investors in open-end mutual funds are typically offered daily opportunities to redeem their outstanding shares directly from the fund or to purchase additional and newly issued shares in the fund. This liquidity mismatch raises issues about the extent to which investors will receive liquidity when they need i most and whether realized returns of some investors will be affected by the exit and entrance of other investors who are timing or arbitraging stale prices.

* Discuss options and futures on real estate indices

Challenges to real estate derivative pricing and trading include difficulties that arise with the highly heterogeneous and illiquid assets comprising the indices that underlie the derivative contracts. The indices underlying the derivatives may not correlate highly to the risk exposures faced by market participants,

* Identify and describe exchange-traded funds based on real estate indices

ETF Good

1. Relatively low-trading-cost

2. Tax efficient

3. Offer stock-like features, such as liquidity, dividends and possibility to go short or with margin

ETF on real estate indices bad:

1. Raises issues of basis risk to hedgers

2. As REITs are publicly traded, the use of ETF on REITs may offer cost-effective diversification, but may not offer substantially distinct hiding or speculation opportunities

* Identify and describe closed-end real estate mutual funds

A closed-end fund is an exchange-traded mutual fund that has a fixed number of shares outstanding to public in an IPO.

A closed-end real estate mutual fund is an investment pool that has real estate as its underlying asset and a relatively fixed number of outstanding shares

* Discuss equity real estate investment trusts

An equity REIT acquires, renovates, develops, and manages real estate properties. It produces revenue for its investors primarily from the rental and lease payments it receives as the landlord of the properties it owns. An equity REIT also benefits from the appreciation in value of the properties it owns as well as any increase in rents.

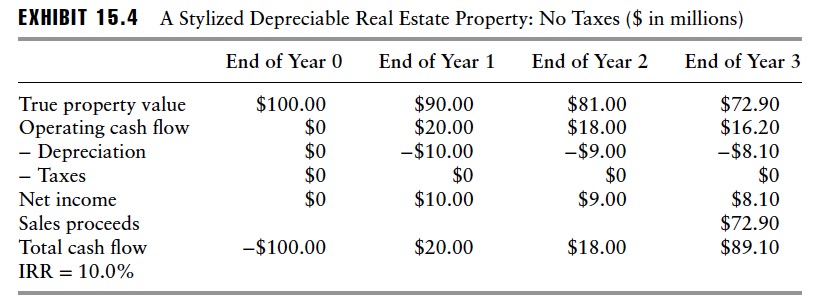
Advantage: REITs are publicly traded

## Demonstrate knowledge of depreciation of real estate.

* Describe and apply various methods of depreciation of real estate in the analysis of returns

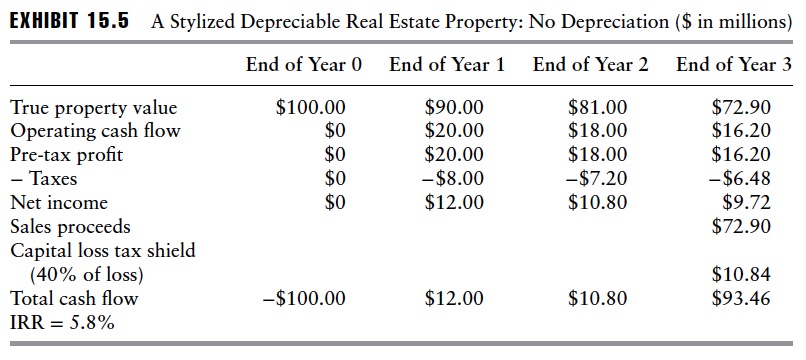
1. Without income taxation

operating income = 10% of property’s value at end of last year + amount decline in property value



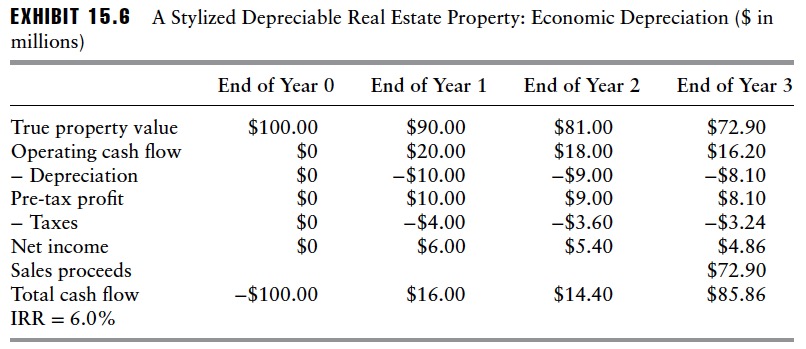
2. With depreciation disallowed for tax purposes

To include tax rate = 40%



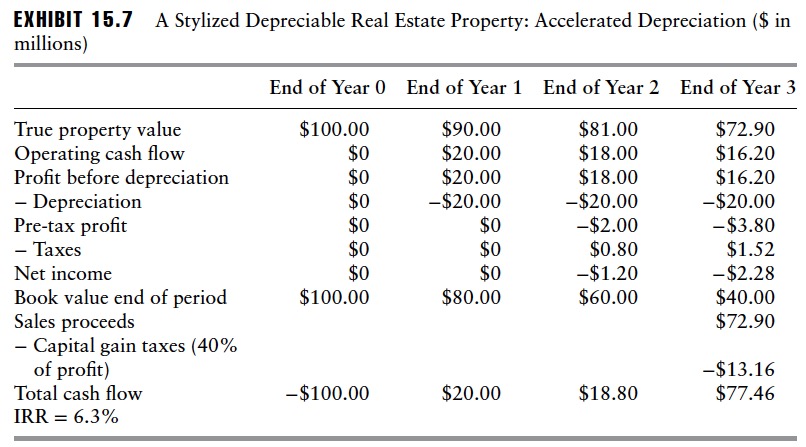
3. With economic depreciation (=economic depreciation) allowed for tax purposes

To include depreciation for tax accounting purpose = true economic depreciation of decline in property value

Note: the speed of depreciation method does not affect the aggregated taxable income, but changes timing of taxes. When time value of money is included, the depurate rate changes the after-tax IRR and effective tax rate.

4. With accelerated depreciation allowed for tax purposes

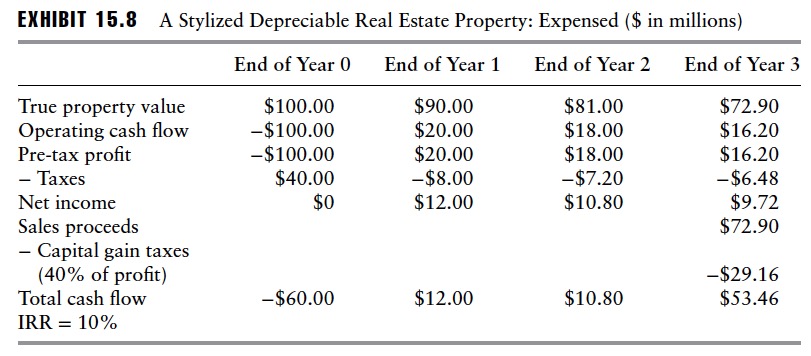
To include most common situation in practice: accounting depreciation for tax purpose is allowed to write off the value of an asset more quickly than it is actually declining in value



Note: when depreciation for tax accounting purpose is accelerated in time relative to true economic depreciation, the after-tax return generally exceeds the pre-tax return reduced by the stated income tax rate.

5. With expensing of capital expenditures for tax purposes

Situation where capital expenditures are allowed to be immediately and fully deducted, or expensed, for income tax purposes.

Note: when depreciation for tax accounting purposes occurs at the same rate as true economic decline in the value of the asset, the value of the depreciation tax shield drives the effective tax rate to equal the stated tax rate. In other words, the after-tax IRR will equal the pre-tax IRR reduced by the stated tax

## Demonstrate knowledge of real estate equity risks and returns as represented by real estate indices.

* Discuss real estate indices based on appraisals

The NCREIF Property Index (NPI) is the primary example of an appraisal-based real estate index in the United States and is published by the National Council of Real Estate Investment Fiduciaries (NCREIF), a not-for-profit industry association that collects data regarding property values from its members.

1. NPI is frequently used as a proxy for the performance of direct investments in commercial real property. More specifically, it proxies the returns for an institutional-grade real estate portfolio held by large U.S. investors.

2. NPI is calculated on an unleveraged basis (purchased with 100% equity and no debt), so the returns are less volatile

3. The returns to the NPI are calculated on a before-tax basis and therefore do not include income tax effects.

4. Returns calculated for each individual property and then are value-weighted in the index calculation

5. NCREIF based on appraisal (professional opinions regarding property value)

* Identify and describe data smoothing and its major effects

Dampened price changes result from the tendency of appraisers to undervalue assets with values that are high relative to recent values, and to overvalue assets with values that are low relative to recent values.

Two reasons why professionals misvalue assets:

1. Professional appraisers may receive information regarding changes in market conditions on a delayed or lagged basis because nobody is able to maintain current knowledge on all market conditions;

2. Appraisers, like other humans in similar situations, are reluctant to recognize large value changes as being unbiased

Three impacts from smoothing

1. A smoothed index lags he true values of the underlying real estate properties, both up and down

2. Reported volatility of the index is dampened. This lower volatility results in a more attractive risk-adjusted performance measure, such as higher Sharpe ratio

3. NPI does not react to changes in macro-economic events as quickly as stock and bond indices. => lower correlation coefficients of smoothed real estate index with traditional stock and bond indices

* Discuss real estate indices based on adjusted privately traded prices

Infrequent trading is a char of real estate. It is so slow that unrealistic to maintain a price index based purely on most recently observed price for each property

Computation of private real estate returns using transaction data can cause smoothing of reported returns and underestimation of volatility due to a selection bias

**Impact**: lag true price changes in both bull markets and bear markets

A **hedonic price index** estimates value changes based on an analysis of observed transaction prices that have been adjusted to reflect the differing characteristics of the assets underlying each transaction.

* Discuss real estate indices based on market prices

Unlike private real estate, the reported returns of REITs are based on observations of frequent market prices

Additional risk relative to private real estate investment

1. high correlation with equity market indices, no representative of true correlations between equity markets and the underlying real estate.

## Demonstrate knowledge of historical performance of equity REITs.

### Recognize inferences that can be drawn from comparing definable characteristics of equity REITs with their historical stand-alone and portfolio performance

1. US equity REITs enjoyed very high average annualized returns compared to world equities, bonds, and commodities. The risk-adjusted return is relatively same.

2. High return correlation \rho(equity REITs, global equities) and \rho (equity REITs, US high-yield bonds). modest correlation \rho(equity REITs, global bonds or credit spreads or commodites)

# Chapter 16 Structure of the Hedge Fund Industry

## Demonstrate knowledge of the distinguishing features of hedge funds and their growth and concentration over time.

### Identify and describe the three primary elements of hedge funds

1. privately organized in most jurisdictions

2. usually offers performance-based fees to its managers

3. usually apply leverage, invest in private securities, invest in real assets, actively trade derivative instruments, establish short positions, invest in structured products, and generally hold relatively concentrated positions

* Recognize the six investment flexibilities offered by hedge funds

6 major investment flexibilities used by hedge funds

1. Hedge fund strategies often invest in nonpublic, unlisted securities (no prospectus, public offering)

2. Use leverage at times very large amounts. Mutual funds can borrow up to 33% of their underlying assets, while hedge funds do not have this restriction

3. Use derivative strategies much more predominantly than traditional investments like mutual funds.

4. Take short positions in securities to increase return or reduce risk

5. Trade in more esoteric or riskier underlying investments (e.g. structured)

6. Be more actively managed with more complex strategies and with more dynamic risk exposures than traditional funds

* Discuss the reasons for hedge fund industry growth and concentration

There are many reasons for huge interest in hedge funds

1. Hedge funds return can offer low correlation wth traditional investments (=>diversifiers)

2. Hedge funds have investment flexibility, such as go both long and short

3. Potential double-digit returns of hedge fund industry

**Consolidation** is an increase in proportion of a market represented by a relatively small number of participants (i.e. industry concentration)

1. Larger funds are less risky: they are seeking to invest with stable firms with demonstrated risk management processes and strong operational risk controls.

2. Exposure to hedge funds of facilitating due diligence by investors

## Demonstrate knowledge of hedge fund fees

### Recognize typical hedge fund fee arrangements

Hedge fund fee = management fee + an incentive (or performance) fee

Def: Incentive fee is a constant percentage applied to net asset value (NAV) of the fund = assets - liabilities

e.g. 2 and 20: annual management fees of 2% and incentive fees of 20%

* Calculate annual hedge fund fees

Annual Fee = Management Fee + { Max[0, Incentive Fee x (Gross Return above HWM - Management Fee − Hurdle Rate)]}

where management fee, incentive fee and hurdle rate are percentage

**HWM**: high-water mark of the fund

E.g. 1.5 and 30 fee arrangement, with no hurdle rate and NAV = 200MM at start of year. At end of year, NAV = 253MM before fees. Assuming management fees are computed on start-of-year NAVs and are distributed annually, find the annual management fee, incentive fee and ending NAV after fees, assuming no redemptions or subscriptions

annual management fee = 1.5% x 200MM = 3MM. The fund earned profit of 50MM = 253 - 3 - 200. The incentive fee = 50x30% = 15MM. Therefore, ending NAV = 253 - 3 - 15 = 235MM

* Describe and apply high-water marks (HWMs) and hurdle rates

HWM is the highest NAV of fund on which an incentive fee has been paid. Thus, HWM is highest NAV recorded on incentive fee computation dates, but not necessarily the highest overall NAV

* Discuss the potential effects of incentive fees on hedge fund manager behavior

Unlike hedge fund managers, most traditional investment managers do not receive fees based on performance

**Managerial** **co**-**investing** is an agreement between fund managers and fund investors that the managers will invest their own money in the fund

Good: manager will work harder

Bad: excessive conservative

Def: **Perverse incentive** is an incentive that motivates the receiver of the incentive to work in opposition to the interests of the provider of the incentive

* Recognize and apply the annuity view of hedge fund fees

To demonstrate the potential value of an annuity of fees available to hedge fund managers to illustrate the manager’s incentive to maintain profitability

The **annuity view** of hedge fund fees represents the prospective stream of cash flows from fees available to a hedge fund manager.

incentive = (profits - management fees (2%)) x incentive%

NAV beginning year 2 = NAV year 1 + profits - management fees (2%) - incentive fees (20%)

* Recognize and apply the option view of incentive fees and its implications on manager behavior

Focus on one-period model of fees with zero hurdle rate

Incentive fee option value is the risk-adjusted PV of incentive fees to a manager that have adjusted for its optionality

Incentive Fee call option value ~=

where

i: incentive fee percentage

: volatility of assets over option life (annual volatility)

* Describe the empirical evidence regarding hedge fund fees and managerial behavior

1. The annuity view of hedge fund fees indicates the enormous fees available to managers for being able to sustain long-term growth in assets

2. The option view of hedge fund fees indicates the enormous gains in single-period expected incentive fees that managers can generate by increasing the volatility of funds’ assets

Empirical study

1. Managers may take fewer risks after a period of high returns and take more risks after a period of negative returns

2. Managers may modify the time series of returns to enhance risk-adjusted performance or to improve the number of profitable months

Def: **managing returns / massaging returns** refer to efforts by managers to alter reported investment returns toward preferred targets through accounting decesions or investment changes

## Demonstrate knowledge of various types of hedge funds.

### List hedge fund strategies

1. Macro and managed futures funds: macro vs managed futures

2. Event-driven hedge funds

1) Activists

2) Merger Arbitrage

3) Distressed

4) Event-driven Multistrategy

3. Relative value hedge funds

1) Convertible arbitrage

2) Volatility arbitrage

3) Fixed-income arbitrage

4) Relative value multi-strategy

4. Equity hedge funds

1) Long short

2) Market Neutral

3) Short selling

5. Funds of hedge funds

multi-strategy fund: deploys its underlying investments with a variety of strategies and sub-managers, much as a corporation would use its divisions.

Fund mortality: the liquidation or cessation or operations of funds, illustrates the risk of individual hedge funds

## Demonstrate knowledge of various hedge fund strategies

Hedge fund program refers to the process and procedures for the construction, monitoring, and maintenance of a portfolio of hedge funds

There are 4 groups of hedge fund strategies

1. Equity strategies: substantial market risk

2. Event-driven strategies, to earn returns by taking on event risk, such as failed mergers. Relative value strategies, to earn returns by taking risks regarding the convergence of values between securities

3. Absolute return strategies: to minimize market risk and total risk

4. Diversified strategies, to diversify across a number of different investment themes

* Identify and describe equity strategies

Substantially exposed to stock market risk include equity hedge and short bias funds. For example, 100% long exposures, with 60% gross short exposures. 40% net market exposure (40% beta risk), the investors are exposure to 160% exposure to manager’s stock selection skills.

* Identify and describe event-driven and relative value strategies

1. lowest standard deviation with largest values of negative skewness and excess kurtosis

2. earned small profits but are prone to posting large losses over short periods of time

3. generally hold hedged positions

4. For example, a merger arbitrage, managers seek to hold equal and offsetting amounts of stock market risk in their long and short positions involved in a merger

5. For merger arbitrage, 74% of time experienced monthly return 0% to 2%, very favorable compared to equity market, where returns are more dispersed. However, merger arbitrage is exposed to extreme losses due to significant event risk, as the return exhibit large values of negative skewness and excess kurtosis

6. Event risk is effectively an off-balance-sheet risk, a risk exposure that is not explicitly reflected in the financial statements

7. Convergence strategies profit when relative value spreads move tighter, meaning two securities move toward relative values that are perceived to be more appropriate

8. LTCM: using valuation convergence: valuations of similar securities converges

* Identify and describe absolute return strategies

1. **Absolute return** products are investments in which the returns are designed to be consistently positive rather than being linked to or assessed against broad market performance

2. Hedge funds can offer a quite different return profile than mutual funds (relative return products)

3. Two strategies to have absolute return: **equity market-neutral** and **market**-**defensive** **funds** of funds. These strategies stand out for low standard deviations, low drawdowns, low correlations to equity markets, and skewness and kurtosis statistics that are close to normality

* Identify and describe diversified strategies

1. Diversification: Global macro, systematic diversified funds (i.e. managed futures funds), multi-strategy funds, and funds of funds

2. high returns, reasonable risks, and low drawdowns

3. return symmetric: global macro and systematic diversified funds

## Demonstrate knowledge of hedge fund investment programs.

* Identify and explain the parameters that may be used in a hedge fund investment program

1. Absolute return parameters should operate at two levels

1). Individual hedge fund manager

2). Overall hedge fund program

2. consistent positive performance and low correlation with traditional asset classes

3. Shocks to one segment of hedge fund industry can be felt across many different hedge fund strategies

4. Future results differ from past results

5. survivorship bias or selection bias exists in the empirical studies

* Discuss three caveats that relate to the documented hedge fund investment performance and diversification benefits

1. Def: **Opportunistic investment strategy**: when a major goal is to seek attractive returns through locating superior underlying investments.

2. There are several ways to be opportunistic:

1). specialization in a sector or in a market strategy

2). more rapid trading and more concentrated positions

3. Opportunistic hedge funds may be selected not necessarily to reduce the risk of an existing investment portfolio but to complement its risk versus return profile. Opportunistic investing can lead to more mean-variance-efficient investing, a broader investment universe, and the freedom to allow managers to trade on an expanded information set.

## Demonstrate knowledge of the market impact of hedge funds

* Discuss the evidence regarding the market impact of hedge funds during the Asian currency crisis of 1997

Def: **Headline risk**: dispersion in economic value from events so important, unexpected, or controversial that they are the center of major news stories.

There were certain instances in which hedge funds did have an impact on the market, most notably with the devaluation of the pound sterling in 1992. However, in no case was there evidence that hedge funds were able to manipulate the financial markets away from their natural paths driven by economic fundamentals.

E.g. the sterling came under pressure in 1992 due to large capital outflows from UK. Soros bet correctly against the sterling and exacerbated its decline, but he did not trigger the devaluation.

* Discuss the evidence regarding the market impact of hedge funds during the crisis of 2007

1. The return patterns of that week were a sign of a liquidity trade that can be explained as the consequence of a major hedge fund strategy liquidation

2. Unlike banks, hedge funds can withdraw liquidity at any time and that a synchronized liquidity withdrawal among a large group of funds could have devastating effects on the basic functioning of financial system

3. Hedge fund industry has facilitated economic growth and generated social benefits by providing liquidity, engaging in price discovery, discerning new sources of returns, and facilitating the transfer of risk

4. Hedge fund engaging in short-selling activity may actually be reducing market volatility, as they seek to see assets as prices rise and buy assets as prices fall.

## Demonstrate knowledge of hedge fund indices

* Describe hedge fund indices

Hedge fund indices are constructed and published for 2 key reasons

1. serve as a proxy for a hedge fund asset class, important for asset allocation studies

2. serve as performance benchmarks to judge the success or failure of hedge fund managers

* Describe the challenges caused by management and incentive fees in constructing hedge fund indices

All hedge fund indices calculate hedge fund performance net of fees. There are two concerns:

1. Incentive fees are normally calculated on an annual basis. However, all of these indices provide month-by-month performance. Therefore, on a monthly basis, incentive fees must be forecasted and subtracted from performance.

2. Hedge funds are a form of private investing, the terms of specific investments in hedge funds may not be negotiated in a consistent manner among different investors or across different time periods

Def: **Fee bias** is when index returns overstate what a new investor can obtain in the hedge fund marketplace because the fees used to estimate index returns are lower than the typical fees that a new investor would pay

* Recognize the challenges of including managed futures in hedge fund indices

1. Managed futures fund (or commodity trading advisers, CTAs) are sometimes considered as a subset of hedge fund universe, and included in index construction

2. These are investment managers who invest in commodity futures markets, using either fundamental economic analysis or technical analysis. They may invest in financial futures, energy futures, agriculture futures, metals futures, livestock futures, or currency futures.

3. CTA investment / trading style (mostly trend-following models) and markets they invest in are different from hedge fund university, the returns may vary across hedge fund indices

* Compare asset-weighted hedge fund indices and equally weighted hedge fund indices

1. Equal weighting has the advantage of not favoring large funds or hedge fund strategies that attract a lot of capital, like global macro or relative value. Bad: small funds together have an extremely large weight in the reported index returns, yet a relatively small role in determining the returns experienced by actual investors in hedge funds

2. Asset-weighted is dominated by large funds and is therefore influenced by the flows of capital. Bad: largest funds choose not to report their data to public databases, so it may be difficult to interpret an asset-weighted index return

* Discuss the role of the size of the hedge fund universe in the construction of a hedge fund index

The size of total universe of hedge funds is not known with certainty,

1. stems from its loosely regulated nature.

2. attrition rate for hedge funds is quite high

In conclusion, there are large differences in compositions of various hedge fund indices with relatively little overlap

* Recognize the concepts of representativeness and data biases (e.g., survivorship, selection, instant history, liquidation) and their effects on hedge fund returns reported by databases

1. Survivorship bias occurs when the historical returns of a defunct fund are dropped from a database, are dropped from historical index return computations, or are not proportionately reflected in the construction of indices

2. Lack of regulatory environment for hedge funds creates opportunity for other data bias in addition to survivorship bias

1) selection bias: index disproportionately reflects the char of managers who choose to report their returns.

2) backfill bias (or instant history bias), occurs when an index contains histories of returns that predate the entry date of the corresponding funds into database and thereby cause the index to disproportionately reflect the char of funds that are added to database. (i.e. only report recent successful period returns)

3) liquidation bias, occurs when an index disproportionately reflects the char of funds that are not near liquidation. Opposite to survivorship bias, it involves partial reporting of returns of defunct funds.

Def: **Participation bias** may occur for a successful hedge fund manager who closes a fund and stops reporting results because the fund no longer needs to attract new capital

* Recognize the challenges involved in defining hedge fund strategies, and the effect of style drift

Strategy definitions, the method of grouping similar funds, raise two problems:

(1) definitions of strategies can be very difficult for index providers to establish and specify

(2) some funds can be difficult to classify in the process of applying the definition

* Identify issues that determine investability of hedge fund indices

Def: The **investability of an index** is the extent to which market participants can invest to actually achieve the returns of the index.

There are numerous reasons that a market participant cannot simply hold a portfolio equivalent to the portfolio implied by a hedge fund index.

1. hedge fund investments often have capacity limitations.

2. closed funds, less investability of index

# Chapter 17: Macro and Managed Futures Funds

## Demonstrate knowledge of major distinctions within the category of macro and managed futures funds

* Distinguish between discretionary fund trading and systematic fund trading

1. **Discretionary** **fund** **trading** occurs when the decisions of the investment process are made according to the judgment of human traders. Can involve some calculation or computer help, but mainly human judgment

2. **Systematic** **fund** **trading**, often referred to as black-box model trading because the details are hidden in complex software, occurs when the ongoing trading decisions of investment process are automatically generated by computer programs. Though computer programs are designed by human, but ongoing application of program do not involve substantial human judgment.

* Define technical analysis and fundamental analysis, and discuss the reasons for pursuing each

1. Technical analysis relies on data from trading activity, including past prices and volume data.

1) One motivation for using technical analysis is based on the idea that prices already incorporate some economic information, but price patterns may be identified that could be exploited for profit opportunities.

2) A belief that market prices are substantially determined by trading activity that is unrelated to a rational analysis of underlying economic information

2. Fundamental analysis uses underlying financial and economic information to ascertain intrinsic values based on economic modeling (using underlying economic factors)

## Demonstrate knowledge of global macro funds

There are sufficient similarities between macro funds and managed futures funds. Global macro funds are more likely to be discretionary and emphasize fundamental analysis, whereas managed futures tend to be more systematic and emphasize technical analysis.

* Describe the key characteristics of global macro funds

1. Global macro funds have the broadest investment universe: not limited by market segment, industry sector, geographic region, financial market, or currency, and therefore offer **high diversification**

2. **Low correlation** to stock and bond investment, as well as to other types of hedge funds

3. Large amounts of investor capital

4. May apply leverage to increase the size of their macro bets

* Be familiar with examples that illustrate the foundation of global macro trading strategies

Potential profit when national governments impose fixed or managed exchange rates. Most found in countries where government has mandated fixed or managed currency rates between its currency and other currencies. Traders monitor these currencies and estimate the likelihood of a currency revaluation or devaluation to a price other than the official rate.

Example 1: GBP in euro cannot deviate more than 6% to official rate. GBP tends to devalue

Example 2: Thailand, Malaysia and Indonesia had currency rates pegged relative to a basket of currencies, with a heavy weight to US dollar. Soros short sold these currencies at government-supported fixed exchange rates, and the respective governments seemed to be the only buyers. Each government exhausted its official reserves and was forced to stop the defense of its currency. Then their currency moved to freely floating value. Within short time, currencies decline by 40% to 70%.

* Recognize the main risks (i.e., market, event, and leverage) of macro investing

3 primary risks of macro investing

1. **Market** **risk**: directional moves in general market price levels. E.g. changes in governmental policies will lead to large moves in underlying markets. Macro funds not focus on equity markets, however, highly on currency, commodity, and sovereign debt markets.

2. **Event** **risk**: sudden and unexpected changes in market conditions resulting from a specific event. Macro funds tend to benefit from particular events. As macro funds seek out situations of event risk at macro-economic level, there have substantial changes in value over short periods of time

3. **Leverages**: use of financing to acquire and maintain market positions larger than AUM.

## Demonstrate knowledge of the historical performance of macro investing.

* Recognize inferences that can be drawn from comparing definable characteristics of macro investing with its historical stand-alone and portfolio performance

Macro fund monthly returns (CSGMI)

1. Relatively high return and low risk vs global equities

2. Modest correlation between CSGMI strategy and world equities

## Demonstrate knowledge of managed futures

* Describe the key characteristics of managed futures funds

Managed futures refers to active trading of futures and forward contracts on physical commodities, financial assets and exchange rates.

1. Skill-based style of investing

2. based on systematic trading more than discretionary trading.

3. More technical analysis as opposed to fundamental analysis

* Discuss regulation, background, and organizational structures of the managed futures industry

There are 3 ways to access the skill-based investing of managed futures industry

1. **Public** **commodity** **pools**: similar to mutual funds; low min investment and high liquidity (allowing withdraw with relatively short notice)

2. **Private** **commodity** **pools**: similar in structure to hedge fund; avoid lengthy or burdensome initial regulatory requirements; lower fees and greater flexibility to implement investment strategies

3. **Individually** **managed** **accounts**: like hedge funds, CTAs and CPOs charge management fees and incentive fees.

Commodity pools are investment funds that combine the money of several investors for purpose of investing in futures markets. Public commodity pools open to general public. It must file with SEC before distributing shares to investors. Private commodity pools are open to privately high-net-worth investors and institutional investors.

A managed account (or separately managed account) is created when money is placed directly with a CTA in an individual account rather than pooling with other investors.

## Demonstrate knowledge of systematic trading

Systematic trading refers to automation of investment process, not to systematic risk, which applies a fixed set of trading rules in determining when to enter and exit positions. Deviation from system’s rules is generally not permitted.

* Identify methods for and issues involved in deriving systematic trading rules

Usually derived from backtests

Def **Slippage**: unfavorable difference between assumed entry and exit prices and entry and exit prices experienced in practice.

Systematic traders rarely employ only a single trading system with a single security

Over time, managers may modify their trading systems, develop new ones, and abandon other

* Recognize key questions to ask when evaluating individual trading strategies

There are 3 useful questions to ask when evaluating in individual trading strategies

1. What is the trading system, and how was it developed? Purpose: understand broad underlying trading approach and specific char of strategy itself; research methods to identify and develop trading strategy to avoid strategies based on spurious results from data dredging

2. Why and when does the trading system work, and why and when might it not work? purpose: to understand the underlying hypothesis of a specific trading strategy.

3. How is trading system implemented? Many operational factors contribute to a successful systematic trading strategy, including selection of data sources, determination of periodicity of data, establishment of protocols to clean the data, processing the data into a trading signal, placement of trades, record keeping, and broker reconciliation

* Describe key components of methods used to validate systematic trading rules and the detection and effects of trading rule degradation

Rely on quantitative research methods that backtest trading rules using historical price data

**Validation of trading rule**: use of new data or new methodologies to test a trading rule developed on another set of data or with another methodology

**Robustness**: reliability with which a model or system developed for a particular application or with a particular data set can be successfully extended into other applications or data sets

Vital to know how many trading rules were tested, how many were subjected to validation, and how many were rejected in the validation process.

## Demonstrate knowledge of systematic trading strategies

Systematic trading strategies are generally categorized into 3 groups: trend following, non-trend following, and relative value

* Describe the characteristics of trend-following strategies

1. Designed to identify and take advantage of momentum in price direction (i.e. trends in prices).

2. Uses recent price moves per some specific time period to identify a price trend.

3. Goal: long assets experiencing an upward trend, and short positions in assets experiencing a downward trend

For example: simple moving average: most basic approach for trend following strategies

Strategy: enter long position, if > (n)

Trading signal for example

1. when the current price > 2 or more moving averages

2. when a shorter-term moving average crosses up and over a longer-term moving average

3. when moving averages align upward (i.e. all in the same direction, with shorter moving averages exceeding longer moving averages)

* Define and apply simple moving averages, weighted moving averages, and exponential moving averages

1. Simple moving averages: equal weights: 1/n

2. Weighted moving average (WMA): , where

3. Exponential moving average: geometrically declining moving average based on weighted parameter between 0and 1

Example to use two moving averages

1. Sell (short) if 10-day moving average < 45-day moving average

2. Buy (long) if 10-day moving average > 45-day moving average

* Define and apply breakout trading rules

Def: identifying commencement of a new trend by observing the range of recent market prices (e.g. looking back at the range of prices over a specific time period). If current price is below all prices in the range, the strategy identifies as breakout

For example, past 10-day stock prices: 100, 102, 99, 98, 99, 104, 102, 103, 104 and 100. A price of 105 signals a **long** position; and 97 would signal a breakout on the downside and would typically be interpreted as a **sell** signal.

* List the conclusions of research on the nature and efficacy of trend-following strategies

1. Trend following is dominant strategy in managed futures (dominant style by CTAs)

2. 2 draw-back about trend-following strategy

1) Slow to recognize the beginning or end of trend

2) Moving average rule may not persist in competitive markets

3) Some trader has described trend-following as long volatility strategies. Reason: profit when market prices make large unidirectional changes and that large unidirectional changes generate higher reported volatility.

* Identify non-trend-following strategies and their trading signals

1. Def: designed to exploit non-randomness in market movements, such as a pattern of relative moves in prices of related commodities

2. Generally categorized into 2 groups:

1) **counter**-**trend** strategies: statistical measures, such as price oscillation or a relative strength index, to identify range-trading opportunities rather than price-trending opportunities.

2) **pattern** **recognition:** RSI (relative strength index) signal that examines average up and down price changes and is designed to identify trading signals such as price level at which a trend reverses. RSI = 100 - 100/(1+U/D), where U = average of all price changes for each period with positive price changes for last n periods.

- When RSI < 30, market is typically considered **oversold**, and **long** position;

- When RSI > 70, **over**-**bought** market, **short** position

Note: trading time at end of period RIS < 30 or RSI > 70

* Describe the characteristics of relative value strategies

1. To capture inefficient short-term price divergences between 2 empirically or theoretically correlated prices or rates

2. focus on **short** **time frames** (i.e. seconds to days) in managed futures or long time frames (months)

3. Analyze the correlation structure between 2 or more futures contracts and attempt to exploit deviations in prices as individual futures contracts respond differently to new information or to liquidity imbalances

4. Not directly rely on separate behavior of either price series (or not essential if A or B experience trending or mean reversion)

For example: price gap between two contracts, by selling contract A and buying contract B, when spread becomes large relative to past spreads

## Demonstrate knowledge of empirical research on managed futures

Questions to managed futures

1. produce consistent alpha?

2. downside risk protection?

3. sources of returns?

4. potential risks?

* Discuss empirical evidence regarding managed futures returns and the downside risk protection offered by managed futures

Two issues on consistent alpha

1. Actual returns of managed futures funds: CTAs show statistically significant, positive market-timing ability

2. Returns to funds based on simulations of well-known trading strategies (momentum, such as trend following) using historical prices:

In general, empirical research **supports** inclusion of managed futures in a **diversified** portfolio context

Downside risk protection

1. managed futures and macro funds do not experience the strong correlation to stocks in down markets

2. managed futures returns have historically had the rare and attractive quality of having a **positive** correlation to various stock indices in **rising** equity markets; and a **negative** correlation or near zero correlation during **falling** markets

Empirical evidence **supports** managed futures to diversify a stock and bond portfolio when analyzed in a mean-variance framework. that is: estimation of return, correlation and variances indicates that returns of managed futures have provided enhanced investment opportunities

### Describe the reasons why managed futures might provide superior returns

CTAs trade futures contracts

1. with underlying in broad asset classes, such as equities, commodities, currencies an fixed-income instruments

2. highly liquid, with narrow bid-ask spread

Source of alpha

1. most futures contract are used as hedging instruments. A large group of futures market participants are **natural** **hedger**, where a market participant seeks to hedge a risk that springs from its fundamental business activities. CTAs earn a return by accepting risks that natural hedgers want to avoid. CTAs are able and willing to accept this risk, as CTAs tends to hold diversified portfolios of futures contracts

### Describe the risks of managed futures funds

1. **Transparency** risk: dispersion in economic outcomes caused by lack of detailed information regarding investment strategy or investment portfolio. investors are difficult to invest in black-box systems, where trading algorithms are not disclosed

2. **Model** risk: failure of models to perform as intended

3. **Capacity** risk: CTAs concentrates trades in a market that lacks sufficient depth (i.e. liquidity)

4. **Liquidity** risk

5. **Regulatory** risk: futures exchanges are especially prone to change margin terms in association with speculation nature

## Demonstrate knowledge of historical performance of managed futures and macro funds.

### Recognize inferences that can be drawn from comparing definable characteristics of managed futures and macro investing with their historical stand alone and portfolio performance

1. HFRI Macro systematic Diversified Index: proxy of managed futures monthly returns

2. HFRI Macro Index: proxy of macro funds returns

Empirical results:

1. Higher mean returns, higher volatility and similar risk adjusted performance, comparing to macro funds

2. High mean returns and reduced volatility of both macro indices, comparing to global equities

3. Substantially higher Sharpe ratios of both macro indices, comparing to global stocks, US high-yield bonds and commodities

4. Low risk of both strategies with min monthly returns and max drawdowns

5. Nearly normally distributed returns, with near-zero skew and nearly mesokurtotic returns

6. Low correlation of both macro indices to most major market indices, including equity market volatility and credit spreads

7. Modest correlation between managed futures returns and world equities

# Chapter 18 Event Driven Hedge Funds

Event driven hedge funds include activist hedge funds, merger arbitrage funds, and distressed securities funds, as well as special situation funds and multistrategy funds that combine a variety of event-driven strategies

## Demonstrate knowledge of the sources of event-driven strategy returns

* Explain the insurance selling view of event-driven strategy returns

1. Existing shareholders of a target firm to sell shared soon after proposed merger announcement

2. Event-driven hedge funds to purchase shares during proposed merger announcement and resolution of uncertainty regarding the event

3. After merger announcement, existing shareholders of target firm need to decide whether to continue to hold their shares, in hopes that the merger will be approved and share prices will rise; or to sell to avoid risk that merger will fail and share price will fall back lower

4. Event driven hedge funds viewed as seeking to earn risk premiums for selling insurance against the failed deals

5. Merger arbitrage hedge fund’s portfolio typically consists of several potential mergers, and therefore its exposure to each deal might be relatively small

6. Merger arbitrage manager is typically able to use derivative securities to manage its exposure to large deals

* Explain and apply the binary option view of event-driven strategy returns

For example, hedge fund purchases the shares at $90, and holds to either merger succeeds with $100 per share, or the merger fail with $70 per share. In this case, it is equivalent to

1. a long position in merger target <=> long position in a riskless bond with 70 face value

2. long position in binary call option, which pays $30 if the deal is consummated and $0 if the deal fails

3. Long binary put option makes one payout when referenced price is lower than the strike price at expiration and a lower payout or no payout in all other cases

In the binary put option view, hedge fund has written a put option on the event such that the hedge fund will bear a loss if the merger does not occur

In the binary call option view, hedge fund has purchased a call option on event such that the hedge fund will gain if the merger is consummated and lose if the event deal does not occur

**Issue**: probabilities of consummation are positively correlated with the performance of overall market.

1. in bull markets and good economic times, mergers and other deals are more likely to be proposed and consummated

2. substantial losses can result during times of market crisis and failed deals

## Demonstrate knowledge of activist investing

Corporate governance describes the processes and people that control the decisions of a corporation.

* Define activist investing, and identify the components of activist investment strategies

**Activist** **investing**: alpha-driven investment strategy, which involves efforts by shareholders to use their rights, such as voting power or threat of such power, to influence corporate governance to their financial benefit as shareholders. Steps include:

1. Identification of corporations whose management is not maximizing shareholder wealth

2. Establishment of investment positions that can benefit from particular changes in corporate governance, such as replacement of existing management

3. Execution of corporate governance changes that are perceived to benefit the investment positions tat have been established

* Identify the various roles in corporate governance

**Shareholder activism**: efforts by one or more shareholders to influence he decisions of a firm in a direction contrary to the initial recommendations of firm’s senior management

* Identify the five dimensions of shareholder activists and the key players in financial activism

1. Financial vs social activists:

1) social objectives include attempts to steer a firm toward behavior deemed by some as more beneficial to society as a whole, such as reduced pollution, better treatment of employees, better treatment of animals, or refusal to manufacture goods such as weapons, alcohol, and tobacco

2) financial objectives, with underlying motivation to increase shareholder wealth through increased share prices

2. Activists vs pacifists

1) Activists oppose current management and seek amor changes in firm’s leadership or decision making

2) pacifists oppose the proposed activism. they support current management, status quo, and any proposed changes outlined by current management

3. Initiators vs followers:

1) initiators of activism search for suitable targets, develop activist plans, establish positions, and implement the plans

2) Active followers support the plans of the initiators and establish positions in firms being targeted by activists

4. Friendly vs hostile activists

1) Hostile activists tend to threaten managers to develop mutually beneficial outcomes

5. Active activists vs passive activists

1) Active activists establish positions for the purpose of activism

2) passive activists participate in activism when they happen to hold positions in the firms that become targets of activism

Note: The key player in successful financial activism are **active** **initiators**, **active** **followers** and **passive followers**

* Discuss agency costs and the conflicts of interest between shareholders and managers

An agent compensation scheme is all agreements and procedures specifying payments to an agent for services, or any other treatment of an agent with regard to employment

The sources of agency costs:

1. the costs of aligning the interests of shareholders and managers

2. unresolved conflicts of interest between shareholders and managers

The misalignment between shareholders’ and managers’ interests stemming from unresolved conflicts of interest often results in potentially major and inefficient consequences, including managers

1. overly risk averse in decision making for fear of being associated with large failure

2. receive excessive compensation from running corporation for their own personal entitlement

3. make decisions based on comfort they obtain from protecting their jobs and existing pay packages

4. impose risk preferences in corporate decision making based on disproportionate participation in the upside of company’s fortunes

5. prefer to avoid hard work or reject optimal change

6. to avoid sharp conflicts, such as challenging unions, demoting employees, firing employees, or closing divisions

* Recognize and discuss approaches commonly used by activist investors to generate alpha

1. activists attempt to accelerate the realization of alpha by seeking to expedite change to the operations of a corporation

2. activist hedge fund positions in target firms can be kept secret as long as the activist owns <5% of target firm

3. in US, form 13D is required to be filed with SEC within 10 days once investor own > 5%

4. in US, form 13G is required of passive shareholders > 5% stake in a firm, but filing may be delayed till 45 days after year-end

5. in US, form 13F is required quarterly filing with QUM > $100MM

Def **toehold**: stake in potential merger target accumulated by a potential acquirer prior to news of merger attempt known

Def **wolf pack**: group of investors who may take similar positions to benefit from an activists’ engagement with corporate management

* Recognize inferences that can be drawn from three types of activist agendas, comparing definable characteristics of activist investing with its historical stand-alone and portfolio performance

Def **interlocking boards**: occur when board members from multiple firms simultaneously serve on each other’s boards and may lead to reduced responsiveness to interest of shareholders

Note: Interlocking boards and exorbitant CEO compensation are typical conflicts of interest that merit resolution and are near the **top** of activist agenda

**Activist** **agenda** **1**: CEOs, Compensation, and Boards of Directors

Good corporate governance efficiently resolves those conflicts of interest that are worth resolving. In particular, conflict of interest and resulting agency costs can become particularly inefficient when a CEO effectively controls the board of directors in one of 2 forms

1. CEO be chairman of board of directors (e.g. CEO-chairman controls both operations and board of directors, with limited checks and balances)

2. board of directors can become too comfortable or friendly with CEO (e.g. excessive pay packages for CEO)

3. total compensation of CEO should be incentive based and appropriate relative to the value generated by management team

**Activist agenda 2**: Capital structure and dividend policy issues

to request change in capital structure or dividend policy of the firm

1. managers have an incentive to reinvest cash inside firm to grow in size and profitability

2. Investors to exploit opportunities for firm with comparative advantage through managerial expertise or other capabilities

3. activist criticize firms for not having enough debt on balance sheet

**Activist agenda 3**: mergers or divestitures

1. Driven by asset-driven motivations, such as operational efficiencies, conglomeration, integration, and reduction in competition

2. When an activist finds a portion of a large corporation that is not maximizing the shareholder wealth, the activist encourages the corporation to sell or spin off shares of business

Def **spin-off** occurs when a publicly traded firm splits into two publicly traded firms, with shareholders in the original firm becoming shareholders in both firms

E.g. A shareholder A owns 300 shares of company 1 before spin-off, may own 300 shares of company A and 100 shares of company B, if each 3 shares of company A spun out 1 share of company B. A spin-off occurs when investors have a choice to own company A or B

## Demonstrate knowledge of merger arbitrage

Merger attempts to benefits from merger activity with minimal risk and is the best-known event-driven strategy

* Recognize the characteristics of merger arbitrage

**1. Stock-for-stock** mergers acquire stock in the target firm using stock of the acquirer and typically generate large initial increases in share price of target firm. Between time of merger announcement and its ultimate resolution, long positions in equity of target firm are generally exposed to relatively modest increases if a merger is completed and larger decreases if no merger occurs => suffer significant event risk

2. **Traditional merger arbitrage** generally uses leverage to buy the stock of firm that is to be acquired and to sell short the stock of firm that is the acquirer. Not work if insufficient liquidity to take short positions. Risk: merger may fail

* Recognize the characteristics of stock-for-stock mergers

For example, acquiring firm offers 2 shares of its stock ($10/share) for each share of target firm. The target rise from $14 to $18 after announcement.

1. Traditional arbitrage: to buy 1 share of target firm fro $18 and sell short 2 shares of acquiring firm, with proceeds of $20.

The fund receives $2 in net proceeds from hedge and hopes to earn this $2 as a profit when merger deal crosses. Regardless of share prices, as long as merger occurs as proposed, the arbitrageur can deliver each share in the target in exchange for 2 shares in acquirer and deliver those 2 shares in satisfaction of the short position.

2. Traditional merger arbitrage is a form of insurance underwriting. If merger occurs of stock-for-stock deal, merger arbitrage hedge fund manager collects an insurance premium = initial stock price spread between target and acquirer. If fails, merger arbitrage hedge fund manager has to pay out on insurance policy and loses money on failed merger

* Discuss the effects of third-party bidders and bidding wars on merger arbitrage

Def: case where another company will enter into a bidding contest

Def **bidding contest** or bidding war is when >=2 firms compete to acquire the same target.

1. Bidding contest dramatically changes the initial dynamics of arbitrage. The onset of a bidding war can create **lucrative** (cost-effective) **returns** to traditional merger arbitrage transactions, but these deals can be among the riskiest situations

Def **antitrust** **review**: government analysis of whether a corporate merger or some other action is in violation of regulations through its potential to reduce competition

2. merger arbitrage is subject to several sources of event risk

1) regulatory risk

2) financing risk

* Describe regulatory risk in the context of merger arbitrage

Def: economic dispersion caused by uncertain outcomes of decisions made by regulators.

1. Regulators may not allow a proposed merger to take place:

1) could reduce competition in the given market.

2) nationalistic or tax-related reasons. cross border mergers of commodity-producing firms or national-defense-related firms tend to be especially politically sensitive

2. Three possible outcomes to an antitrust ruling: yes, no and conditional, where conditional approval may require divestiture of some assets before merger is completed, bringing balance to market

* Describe financing risk in the context of merger arbitrage

Def: economic dispersion caused by failure or potential failure of an entity to secure funding necessary to consummate a plan

- stock swap deals, regulatory issues and the fit between two firms

- when there is cash component to merger offer, evaluation of financing risk, which is ability of acquiring firm to acquire cash necessary to fund the purchase

Note: leveraged buyouts are particularly sensitive to financing risk, and were a key source of merger activity between 2005 and 2007

* Recognize inferences that can be drawn from comparing definable characteristics of merger arbitrage with its historical stand-alone and portfolio performance

1. moderately strong average and exceptionally low volatility of cross-sectionally averaged returns of merger arbitrage funds that led to an excellent Sharpe ratio

2. Returns are negatively skewed and leptokurtic

3. steady returns of merger arbitrage funds with very low volatility

4. consistently positive correlation of event-driven fund returns to global equities, US high yield bonds, and commodities

5. negative correlations to changes in credit spreads and changes in equity volatility

6. not correlated to global bonds

7. positive correlation between index of merger arbitrage returns and index of global equity returns

## Demonstrate knowledge of distressed securities hedge funds

Distressed debt hedge funds invest in the securities of a corporation that is in bankruptcy or is likely to fall into bankruptcy

* Distinguish between distressed debt strategies in hedge funds and in private equity

1. Private equity investors take a **long** term view on the value and reorganization potential of corporation,

2. Hedge funds typically take a **shorter**-term trading view on distressed investment

* Define a naked option position

Def **one-off transaction**: has one or more unique char that cause the transaction to require specialized skill, knowledge, or effort.

Divest speculative holdings prior bankruptcy for following reasons

1. to avoid the increased monitoring needs

2. to avoid ending up with inappropriate securities

3. to avoid revelation of embarrassing investment holdings in future portfolio disclosures, meaning to window-dress public view of portfolio.

* Describe the risks and returns of short sales of distressed equities

1. Substantial risk if company’s fortunes suddenly improve

2. As shares in highly leveraged firms resemble call options, short selling distressed equities is therefore analogous to writing naked call options on firm’s assets and gratis a negatively skewed return distribution

* Determine the effect of recovery values on annualized returns for a strategy of buying undervalued debt during the bankruptcy process

1. The job of distressed investor sounds simple: estimate the recovery value, which is the value of each security in the firm based on time it will take the firm to emerge from bankruptcy process and condition in which it will emerge

2. The estimated liquidation or reorganized value of assets is analyzed with the priority of claims to arrive at the estimated recovery rates for each bond issue.

3. The recovery value depends on priority of claims

4. The recovery is sensitive to market conditions in industry. E.g. bankruptcy of electric utility like Enron, the firm is liquidated, and the hard assets like the power plants need to be sold in a relative short time frame. when whole industry is in distress, these assets sell at depressed prices

5. The annualized returns of deals involving distressed investing are highly influenced by the time the company spends under the supervision of bankruptcy court (will affect the holding period when calculating annualized return)

For example, investor A bought senior debt issue at 60% of face value and subordinated debt issue at 30% of face value, that yield eventual recovery values of 80% and 50%, respectively. These recovery values would generate non-annualized returns of 1/3 on senior debt and 2/3 on subordinated debt, assumng no couponincome

* Recognize activist approaches to investing in distressed securities (return & holding period)

1. Activist investors in distressed securities seek to influence both the recovery value and the timing of the exit from the bankruptcy process. It is an intense process that requires a substantial amount of legal work as the manager negotiates with the court and other investors

2. Activist may simply choose to expedite the bankruptcy process by cooperating with other parties, which may lower ultimate recovery rates, but increases annualized returns.

* Describe the characteristics of capital structure arbitrage

It offset positions within a company’s capital structure with the goal of long relatively underpriced securities, short overpriced securities and hedged against risk. The hedged positions have reduced exposure to general risks of economy or the firm and are plays on relative values within the firm’s capital structure

For example, consider a company with 4 levels of outstanding capital: senior secured debt, junior sub-ordinated debt, preferred stock and common stock. There are two standard distressed security investment strategies

1. to buy the senior secured debt and short junior subordinated debt

2. to buy the preferred stock and short the common stock

There are 4 scenarios

1. Bearish extreme, with no recovery received on either bond: the hedge fund breaks even by gaining 10,000 on short position and losing 10,000 on long position

2. Bullish extreme, with full recovery. The loss on short exceeds the gain on long, causing hedge to lose money

3. Senior debt is fully recovered, and junior debt has no recovery, the hedged position gains on both legs of trade and generates a large profit

4. Recovery rates of bonds are equal, junior bond gains more and the hedge generates a net loss

* Explain the strategy of buying distressed firms using distressed securities

A distressed securities hedge fund can become involved in bankruptcy process as a strategy for establishing a controlling position in firms that the fund perceives as substantially undervalued. This strategy has the intention of gaining a controlling interest.

* Recognize inferences that can be drawn from comparing definable characteristics of distressed securities funds with their historical stand-alone and portfolio performance

1. stellar average and relatively low volatility of cross-sectionally averaged returns of distressed funds that lead to outstanding Sharpe ratio over observation period.

2. the returns were negatively skewed and leptokurtic

3. high correlations of distressed funds with global equity returns

4. consistently positive correlation of distressed restructuring fund returns to global equities, US high-yield bonds and commodities

5. negative correlation to changes in credit spreads and changes in equity volatility

## Demonstrate knowledge of event-driven multistrategy funds

* Describe key characteristics of event-driven multistrategy funds

**Event-driven multistrategy funds** diversify across a wide variety of event-driven strategies, participating in opportunities in both corporate debt and equity securities.

1. merger activity is higher when equity returns are strong

2. default rates on debt tend to rise during times of weak equity market performance

Because these to strategies are countercyclical to each other, many managers mix a number of event-driven strategies into a single fund

Def **special situation funds** invest across a number of event styles and are typically focused on equity securities, especially those with a spin-off or recent emergence from bankruptcy

* Recognize inferences that can be drawn from comparing definable characteristics of event driven multistrategy funds with their historical stand-alone and portfolio performance

1. Multi-strategy event-driven funds have similar return char to strategies covered earlier

2. Sharpe ratio higher than global equities and commodities despite a much smaller max drawdown

3. Returns are positively correlated to equities, bonds, and commodities

4. Negatively correlated to changes in credit spread and equity volatilities

# Chapter 19: Relative Value Hedge Funds

## Demonstrate knowledge of relative value strategies.

### Recognize the relative value strategy, and list four styles of relative value hedge funds

Def: take long and short positions that are relatively equal in size, volatility, and other risk exposures. Ideally, the combined positions have little net market risk but can profit from short positions in relatively overvalued securities and long positions in relatively undervalued securities.

1. convertible bond arbitrage

2. volatility arbitrage

3. fixed-income arbitrage

4. relative value multi-strategy funds

### Describe the classic relative value strategy trade

Def: based on premise that a particular relationship or spread between two prices or rates has reached an abnormal level and will therefore tend to return to its normal level. It take a long position in security perceived to relatively underpriced, and short position in security perceived to relatively over-priced

relative value strategies tend to perform well during periods of decreasing volatility and increasing market clam, when positions with diverse values converge and credit spreads narrow

## Demonstrate knowledge of convertible bond arbitrage.

* Define and describe the classic convertible bond arbitrage trade

Def: to purchase a convertible bond believed to be undervalued and to hedge its risk using a short position in underlying equity. The hedge is usually adjusted as underlying stock rises or falls in value

The strategy generates favorable returns, when underlying equity experience volatility **higher** than volatility implied by original market price of bond

### Define convertible bonds, and apply the unbundling approach for pricing convertible bonds

1. Def convertible bonds: hybrid corporate securities, mining fixed-income and equity char into one security

2. It can be viewed as a combination of an unsecured corporate bond and a call option on issuer’s stock

3. in a bankruptcy proceeding, convertible bonds are senior to equity, but junior to senior and collateralized debt issues

Formulas:

1. Convertible bond price = straight corporate debt + implicit equity call option (how to value convertible bond)

2. Conversion ratio = # shares / convertible bonds (i.e. 1 bond = # equity shares)

3. Option strike price = convertible bond face value / conversion ratio

4. Conversion value = current stock price x conversion ratio

5. Conversion premium = (convertible bond price - conversion value) / conversion value (i.e. give how much to convert)

Note: in practice, convertible bonds are not valued by BS option pricing model (used to value short-term equity options), as constant vol assumption not applied to long-dated convertible bond issues

### Define busted, hybrid, and equity-like convertibles

1. In the case of convertible bond, moneyness = strike price implied by conversion option vs price of underlying stock

2. Def **busted convertibles**: bonds with very high conversion premiums, as embedded stock options are far out of money. These bonds behave like straight debt.

3. Def **equity-like convertibles:** bonds with very low conversion premiums, with option that is deep in the money

4. Def **hybrid convertibles**: convertible bonds with moderate sized conversion ratios, with stock options close to ATM

### Discuss short selling in the context of convertible arbitrage

1. The most common convertible arbitrage strategy involves short selling large quantities of common stock underlying convertible bond’s embedded option

2. The short position posts collateral = asset price + margin, known as haircut, usually 2%. Therefore, fund A borrows 100,000 of stock from ABC brokerage firm and short sell the stock into market, fund A must place proceeds of sale (100,000) and 2% more (i.e 2000) as collateral to provide protection to lender

3. lender of securities earns interest on collateral, but typically offers the borrower of securities a **rebate**, which is a payment of interest to securities borrower on collateral posted

4. borrower must pay any dividends due on short stock position so that the securities lender can effectively receive dividends on lent shares

5. lender bears the default risk of borrower, unable to return the shares at the same time the collateral will be insufficient to repurchase the shares in the marketplace

6. Def **special stock**: higher net fees are demanded when it is borrowed. To short seller, receiving a smaller rebate

7. Def **general collateral stocks**: stocks not facing heavy borrowing demand

8. when inventory of stock available to borrowers becomes extremely tight, short sellers may find their position bought in, meaning the broker revokes the borrowing privilege for that specific stock and requires the trader to cover he short position.

9. Def short squeeze: occurs when holders of short positions are compelled to purchase shares at increasing prices to cover their positions due to limited liquidity. As ratio of shares sold short increases relative to total number of freely floating shares, it becomes increasingly difficult to borrow additional shares, and the potential for a short squeeze increases

### Recognize the role complexity plays in making convertible bond arbitrage attractive to some hedge fund managers

Why convertible bond are attractive?

1. a relatively small issuance base, which may offer liquidity or complexity premium

2. convertible bond made complex by conversion options, become especially complex when the bonds stray from plain-vanilla package of corporate debt plus a conversion option to having additional complexities of callable or potable convertibles, dual currencies and/or forced conversion

3. Def **complexity premium**: higher expected return offered by a security to an investor to compensate for analyzing and managing a position that requires added time and expertise

### Identify the four reasons that issuers may continue to offer convertible bonds at attractive prices

1. agents (corporate managers) may underestimate the true costs of issuing convertible bonds. the issuers may not fully appreciate the potential harm to share prices from dilution when implicit options are exercised

Def **Dilution**: takes place when additional equity is issued at below-market values, and the per-share value of holdings of existing shareholders is diminished

2. agents of small firms may have no choice but to issue convertible bonds at attractive prices. In US, most convertible bonds are sold as 144A exempt securities, meaning they are exempt from registration of SEC. As a results, most cannot be sold to retail investors, only among institutional investors. Less liquid than stocks or regular bonds => as such, lower prices and higher returns as a premium for bearing liquidity risk

3. potential substantial conflict of interest between straight bond investors and shareholders with regard to preferred corporate asset volatility.

1) straight bondholder prefer low asset volatility to decrease probability of bankruptcy

2) equity holders have a risk exposure viewed as a call option on firm’s assets => prefer high asset volatility

The incentive to take on excessive risk is reduced if convertible bonds are issued, as any increase in volatility benefits the convertible bondholders as well as the equity holders

4. indirect equity issuance costs are a factor. Corporations use convertible bonds as an indirect way to issue equity, as cost of directly issuing new equity may be high

### Identify the components of convertible arbitrage returns

1. Components of returns includes: interest, dividends, rebates, and capital gains and losses

2. Convertible bond arbitrage income: = bond interest - stock dividends - short stock rebate - financing expenses

3. Convertible bond and stock net capital gains and losses := capital gains on stock and bond - capital losses on stock and bond

4. Components of traditional convertible arbitrage strategy return = convertible bond arbitrage income + convertible bond and stock net capital G/L

5. assuming long convertible bond and short stock, investor earn coupon interest paid on bond, pays any dividends on short stock position, and earns a rebate on the cash proceeds from the short sale of stock

6. 2nd source of convertible bond arbitrageur is gain on stock trading: the larger and more frequent the stock price moves, the greater profits from gamma trading, which are offset though theta, or time decay.

7. The goal of gamma trading is to earn more in profits from gamma than the option value else in time decay. This goal is met when realized volatility of stock > implied vol priced into option when convertible bond is purchased

### Recognize and discuss return drivers and risks of convertible bond arbitrage

1. Delta hedging does not eliminate potential for net capital gains: larger stock moves => more gains through positive gamma exposures

2. buying cheap convertible bonds + short sell underlying stock (delta of convertible bond x conversion ratio)

3. need to rebalance the original delta-hedged position, as delta may change over time

4. As stock price increases, option component moves further in the money, and convertible bond becomes more equity sensitive => delta of convertible bond increases, so arbitrageur must adjust hedge by shorting more shares.

5. How often should rebalance their hedges:

1) pre-specified time intervals: like every day or every hour

2) whenever the stock price changes by a certain amount (e.g. $1 or 1% in stock price)

3) when size of necessary adjustment reaches a certain threshold

6. The worst outcome is when stock price remains unchanged, where hedged position loses value due to theta (time decay)

7. convertible bond is cheap <=> corresponding implied volatility is too low. if realized vol is higher than implied vol, then profits should dominate the theta, resulting in net profits

### Recognize inferences that can be drawn from comparing definable characteristics of convertible arbitrage funds with their historical stand-alone and portfolio performance

1. cross-sectionally averaged returns of convertible arbitrage funds exhibited returns and risk between those of global bonds and US high-yield bonds

2. much larger negative skews and fat tails, consistent with view of relative value strategies being similar to writing out of money options

## Demonstrate knowledge of volatility arbitrage.

### Define and describe the concepts of Vega and anticipated volatility

1. Def **Vega arbitrage**: any strategy attempts to earn a superior and riskless profit based on prices that explicitly depend on volatility

2. There are 3 forms of volatility

1) implied volatility: implied by current price of option based on particular option pricing model

2) anticipated volatility: future level of volatility expected by market participants

3) realized volatility: statistically based estimate of actual historical volatility experienced in marketplace

3. key assumptions about volatility

1) not constant, but mean-reverting, clustering, and has long memory => regime-switching model

2) stay low for some extended period of time till a market shock occurs and vol transitions to a higher level for some period of time

3) vol of vol can be hight, but in long run, vol tends to revert toward some long-term average level

4) equity markets, vol tends to increase as price level decline

5) vol to rise more quickly in response to stock prices falling than it falls in response to stock prices rising

### Recognize instruments used by volatility arbitrage funds

1. trading instruments for vol strategy:

1) exchange-traded options

2) warrants

3) convertible bonds

4) other bonds with embedded options

5) OTC options

6) OTC variance swaps

2. In addition to holding asset with option char, vol strategy funds also hold assets without option char in order to hedge or reduce their net exposure to moves in underlying markets. in order to strictly follow a strict delta-hedging process to hedge away moves in underlying market

3. variance swap: forward contracts in which one party agrees to make a cash payment to the other party base done realized variance of a price or rate in exchange for receiving a pre-determined cash flow

4. Def **variance** **swap** payoff = variance notions value x (realized var - strike var) (<=annualized var percent: 4% means 4)

5. Def **volatility** **swap** mirrors a var swap except the payoff the contract is linearly based on standard dev of return series rather than variance.

volatility swap payoff = Vega notional value x (realized volatility - strike volatility) (e.g. vol = 22.00)

6. variance notional value = Vega notional value / (2x\sqrt(strike variance))

7. attraction to variance swap: offer a pure play on asset return variance without exposure to direction of moves in underlying instrument

### Compare the risks of exchange-traded derivatives and over-the-counter (OTC) derivatives

Generally there are 3 major risks that OTC-traded instruments have relative to positions in exchange-traded instruments

1. tend to offer less counterparty risk. Clearing houses have capital and incentives and powers to demand collateral and creditworthiness of market participants, greatly mitigating the concerns wit regard to integrity of each contract. Moreover, clearinghouses diversify risk away from a single dealer and spread the risk across multiple members

2. tend to offer higher price transparency and less pricing risk

Def **price** **transparency**: information on prices and quantities at which participants are offering to buy (bid) and sell (offer) an instrument

Def **pricing** **risk**: economic uncertainty caused by actual or potential misplacing of positions

3. tend to offer higher liquidity

The price transparency facilitates the use of mark-to-market pricing, which is the use of current market prices to value instruments, positions, portfolios and even the balance sheets of firms. The OTC derivatives often partially or fully replies on pricing based on MtM methodology

### Recognize the types of volatility arbitrage strategies

Def **volatility risk**: dispersion in economic outcomes attributable to changes in realized or anticipated levels of volatility in a market price or rate

Def **correlation risk**: dispersion in economic outcomes attributable to changes in realized or anticipated levels of correlation between market prices / rates

There are 2 types of volatility arbitrage funds

1. market (volatility) neutral: Market neutral volatility funds seek to earn a profit without exposure to changes in volatility levels

2. intentionally exposed (long) to volatility: Long volatility funds can provide valuable tail risk protection during times of rising volatility, when markets are likely to decline

E.g. market neutral vol strategy: offsetting positions in two options with different implied vols in the same underlying assets

### Discuss the characteristics of market-neutral volatility funds

1. assumption: there is arbitrage opportunity between higher implied vol and lower realized vol for some options. or some

### Recognize the challenges of estimating and forecasting dispersion

1. there are numerous conventions for calculating dispersion, sos implied vs realized computations should be compared only when both series are calculated with consistent methodology

2. payoff of variance swaps is linearly related to square of volatility => highly nonlinear relative to volatility: problem: average of volatility or average of variance

### Discuss the characteristics of tail risk strategies and how their performance depends on correlation among assets

1. Def **tail risk**: potential for very large loss exposures due to very unusual events, especially those associated with widespread market price declines

2. Entities with undesirably high exposures to tail risk may seek protection from tail risk, often termed portfolio insurance

3. Def **portfolio insurance**: any financial method, arrangement, or program for limiting losses from large adverse price movements

For example,

1) dynamic trading strategies that hedge losses, such as taking short positions in corresponding futures contracts that are adjusted in size based on market leaves

2) long positions instruments thrive during periods associated with tail risk, such as put options far out-of-money. Problem: often priced very high

4. Tail risk funds tend to be less focused on pure arbitrage, and therefore take positions across markets, attempting to sell overpriced vol and buy underpriced vol in whatever markets can be found

### Discuss the characteristics of dispersion trades

1. classic dispersion trade: market neutral short correlation trade, that typically takes long positions in options listed on equities of single companies and short positions in a related index option.

2. for example, buy options on 50 different large-capitalization firms and short in options in S&P 500 index. The goal is to crate a basket of options on individual assets that mimics the composition of index closely, by matching industry weights of portfolio

3. The key to dispersion trade: relationship between portfolio of options and a single option on a portfolio. The relationship is driven by volatility, which in turn driven by correlations across assets.

### Recognize inferences that can be drawn from comparing definable characteristics of volatility arbitrage funds with their historical stand-alone and portfolio performance

1. cross-sectionally averaged returns of vol funds were low but with modest volatility => modest sharpe ratio

2. negative skew and modest leptokurtosis

3. low volatility and modest overall returns of volatility funds

4. low correlation of volatility fund returns and world equity returns through a scatter diagram

5. vol funds provided nice diversification over the period but exhibited poor average returns

## Demonstrate knowledge of fixed-income arbitrage

**Fixed-income arbitrage**: involves simultaneous long and short positions in fixed-income securities with expectation that over the investment holding period, the security prices will converge toward a similar valuation standard

### Recognize types and characteristics of fixed-income arbitrage strategies

1. speculation that yield curve will become less steep sloped (**yield** **flattener**); more steeply sloped (yield **steepener**); or portions of curve will become more curved or less curved (**yield** **butterflies**). These are examples of **intra**-**curve** **arbitrage** **positions**, as they are based on hedged positions within the same yield curve

2. Def **yield curve** (term structure of interest rates): relationship between yields of various securities and term to maturity

3. Def **inter**-**curve** **arbitrage** **positions**: arbitrage (hedged positions) using securities related to different yield curves, including swap spread trading (arbitraging differences in swap rates) and carry trades

4. Def **carry trades**: to earn profits from carrying or maintaining long positions in higher-yielding assets and short positions in lower-yielding assets without suffering from adverse price movements

### Discuss the risks and returns of sovereign debt in fixed-income arbitrage strategies, and apply the concept of modified duration to bond returns and volatility

1. have distinct credit risks from corporate debt, as government can choose to default on obligations

2. most national government can use monetary policy to alter value of their currency and change the real value of outstanding obligation

3. yield curve arbitrage: driven by temporary imbalances in supply of demand for securities that apparently cause temporary distortions in yield curve

4. kinks in yield curve can happen at any maturity and usually reflect a change in liquidity demand around focal point. These kinks provide an opportunity to speculate on changes in shape of yield curve by purchasing and selling Treasury securities that are similar in maturity

5. Def **riding the yield curve**: holding a bond as yield moves up or down the yield curve due to passage of time

6. Def **Rolling down the yield curve**: process of experiencing decreasing yields to maturity as an asset’s maturity declines through time in an upward-sloping yield curve environment. I.e. if yield curve remains static, 5-year note ages into a lower-yield part of yield curve

7. for example, investor A buy a 5-year note at yield of 5.2% and hold it for 3 years. If the yield curve has not changed over holding period, the resulting 2-year note position will now fall to a yield of 5.0%. As bond’s yield falls from 5.2% to 5% with passage of time, investor has a profit from rolling down the curve, with positive price appreciation.

8. based on differences in slopes along yield curve, an arbitrage trade might be to purchase bonds in upward-sloping maturity range and short bonds in downward-sloping maturity range

9. Def **interest rate immunization**: process of eliminating all interest rate risk exposures. Duration-neutral positions may still be exposed to risks of large or non-parallel interest rate shifts. In order to remain immunization, fund manager needs to regularly adjust the positions to maintain duration neutrality and other risks, like Gamma.

### Discuss and determine the effects of prepayment risk and option-adjusted spreads on asset-backed and mortgage-backed securities strategies

1. Def **effective duration**: measure of IR sensitivity of a position that includes effects of embedded option char

2. When IR rise, borrowers prepay more slowly => rising duration during time of falling bond prices

3. Mortgage-backed securities arbitrage attempts to generate low-risk profits through the relative mis-pricing among MBS or between MBS and other fixed-income securities (e.g. US Treasuries)

4. Def option-adjusted spread (**OAS**): measure of excess of return of a fixed-income security containing an option over yield of an otherwise comparable fixed-income securities without an option after adjustment

5. the yield difference may be attributed to OAS, prepayment risk, credit risk, liquidity risk, mis-pricing, or taxability difference.

6. Formally, OAS is calculated as spread over Treasury spot curve that equates the PV of a bond’s cash flows to its market price, incorporating the fact that the bond’s cash flows may change under different interest rate environments

* Analyze the risks of asset-backed and mortgage-backed securities arbitrage

1. complex risks driven by changes in IR levels, shape of yield curve, the prepayment rates and default rates (refunded by insurance)

2. use of OTC derivative for hedging adds counterparty risk

3. Arbitrage strategy: to buy MBS and sell US Treasury securities when IR exposure of both instruments is sufficiently similar to eliminate most of risk w.r.t. Treasury yield levels. The expectation is: credit spread between MBS and US Treasury will decline and MBS will increase in value relative to US Treasuries

4. fixed-income strategies are generally designed to have profitability independent of direction of general financial markets

5. Arbitrageurs seek out pricing inefficiencies based on relative valuations between securities, instead of making bets on absolute pricing of overall market

6. Various risks summary

1) IR durations: duration lengthens in times of rising rates, and declines in times of falling rates; This duration extension and contraction is exactly the **opposite** exposure desired by investors

2) Credit spreads: ABS and MBS assume credit risks of the underlying loans

3) Prepayment risk: borrowers have the option to refinance their loan at any time. Heightened during times of falling interest rates and robust refinancing activity

4) Volatility/convexity: ABS contains embedded short call options, causing bond prices at or above par to experience **negative** convexity

5) Liquidity and crises: ABS substantially **underperform** sovereign debt during times of a market crisis and flight-to-quality investor response. Liquidity of ABS can decline substantially, whereas OAS can increase dramatically during crisis markets

* Recognize inferences that can be drawn from comparing definable characteristics of fixed income arbitrage with its historical stand-alone and portfolio performance

1. substantial negative skew and leptokurtosis

2. benefited from gains in high-yield bonds but suffered from increases in credit spreads and equity volatility

3. fixed-income arbitrage does NOT have direct exposure to equities

4. high correlation of volatility fund returns and world equity returns

## Demonstrate knowledge of relative value multistrategy funds

* Describe key characteristics of relative value multistrategy funds, and recognize inferences that can be drawn from comparing definable characteristics of relative value multistrategy funds with their historical stand-alone and portfolio performance

1. Def **relative value multi-strategy (RVMS)** funds simply combine one or more relative value strategies (convertible arbitrage, vol arbitrage, or fixed-income arbitrage) within a single fund

2. Rationale to set up RVMS instead of single strategy

1) focusing on a smaller market may have capacity issues

2) opportunities may be cyclical

3) opportunity for diversifications

3. empirical results of RVMS

1) higher returns with lower volatility hen compared to global bonds from 2005 to 2014

2) negative skewness and excess kurtosis of returns

3) returns are highly correlated to global equities and high-yield bonds, with strong negative correlations to changes in credit spreads and equity market volatility

# Chapter 20: Equity Hedge Funds

## Demonstrate knowledge of sources of return for equity hedge funds

### Describe the general design of an equity hedge strategy

All equity hedge funds of all styles share a common strategy focused on taking long positions in undervalued stocks and short positions in overvalued stocks

**Equity long/short funds ($734B)**: have net positive systematic risk exposure from taking a net long position

**Equity market-neutral funds ($48.4B)**: balance short and long positions, ideally matching beta exposure of long and short positions

**Short-bias funds ($5.7B)**: have larger short positions than long positions

There are 3 reasons of consistent superior returns of equity hedge funds

1) Providing liquidity

2) Providing informational efficiency

3) Identify factors that can create profit opportunities

### Discuss providing liquidity as a source of return for equity hedge funds

Def **anxious**: market participants placing (large) orders with more concern about getting the full order executed on a timely basis and less concern about getting most favorable possible price based on short-term movements

Def **liquidity**: transaction executed with minimal disruption to prices

Def **taking liquidity**: institution modifying its portfolio, as the trading activities reduces the current supply of available sellers

Def **providing liquidity**: to increase number of shares available to be bought or sold near current best bid and offer prices

Def **market maker**: market participants who offer liquidity, typically both on buy side and sell side

The purpose of providing liquidity is to earn the spread between bid and offer prices by buying at bid price and sell at offer price

Every time an arbitrageur providing liquidity executes a trade, the taker of liquidity on the other side is receiving a price better than price offered by any other market participant. Thus, provision of liquidity can be long-term source of higher returns to market participants who are skilled at detecting illiquidity and executing appropriate trades

### Discuss providing informational efficiency as a source of return for equity hedge funds

Profit from exploiting the inefficiencies caused by poorly informed traders or traders making decisions based on behavior rather than evidence

Def **short interest**: percentage of outstanding shares that are currently held short

Stocks with high short interest tend to underperform the market, with implication that short sellers are skilled at selecting over-priced securities

Def **asynchronous trading**: example of market inefficiency in which news affecting more than one stock may be assimilated into the price of stocks at different speeds=> hedge fund manager may identify a particular stock has experienced an abnormally large price change due to news affecting the stock, the manager choose another stock with similar price movements but on a delayed basis.

Def **overreacting/under-reacting**: short term price changes are too large or too small, relative to value changes that should happen in perfect informational efficiency

For example, analysis of past market prices may indicate tendencies of stocks to consistently overact in short term to some types of bad news and to eventually correct for overreaction => fund manager can identify the patterns and establish positions that would benefit from repetition of pattern

In market-based economy, best producers of any good tend to earn superior profits; secondary markets provide liquidity and reveal prices that convey valuable information => the most talented and best-informed market participants should be able to earn superior rates of return excess of their costs of analysis

### Discuss the process of using factor analysis to enhance returns for equity hedge funds

Use factor models to find financial variables that explain stock price changes and that might be used in predicting price changes

Bottom-up models vs macro-economic or industrial data

Mama and Fresh shows that small-cap stocks and stocks viewed as value stocks have demonstrated consistently higher returns than large-cap and growth stocks

Key issues about factor model

1) Predictable based on past return factors?

2) Any return factor offering a high expected return be attributable to alpha or beta?

## Demonstrate knowledge of market anomalies

Def **market anomalies**: offer higher expected returns after adjustment for risk, and they are violation of informational market efficiency

### Discuss how market efficiency tests are tests of joint hypotheses

Any finding of consistent superior risk-adjusted returns may be caused by model mis-specification for adjusting returns for risk differentials rather than by market inefficiency

### Identify issues involved in predicting persistence of market anomalies

Anomalies based entirely on empirical observation should be viewed with more skepticism than anomalies that also appear to be consistent with reasoning

When the success of a strategy has a reasonable explanation, the empirical results are more trustworthy,

A reasonable explanation for the anomaly should include

1) From whom the excess returns are being earned

2) Why the entire on the other side of trade is willing to transact at prices that the fund manager perceives as beneficial to the fund and harmful to the other side

### Describe and apply accounting accruals as potential predictors of ex ante alpha

Def **accounting** **accrual**: recognition of a value based on anticipation of a transaction. For example, net income includes accounting accrual, while free cash flow may not include

According to this anomaly, investors seem to focus too much on net income, though free cash flow appears to be the main driver of long-term returns

Investors should ignore higher net incomes that are mostly caused by large accruals (i.e. non-cash items). Problem: inflated short-term profits evolve into reduced subsequent profits when the cash flows associated with those accruals are received, as profits have already been recognized

where STDEBT: short-term debt; D&A: depreciation and amortization expense

Empirically, firms with especially large accruals tend to have negative future earnings surprise tat lead to stock price underperformance

### Define price momentum, and recognize its potential role in generating ex ante alpha

Def **price momentum**: trending in prices such that an upward price movement indicates a higher expected price and a downward price movement indicates a lower expected price

A strategy based on price momentum is a trend-following strategy, where stock prices are believed to have positive serial correlation

All-informed investors cannot take large positions in stocks, as their superior information is likely to be leaked to the market. Thus, these investors have to build positions in equities gradually

### Define earnings momentum, and recognize its potential role in generating ex ante alpha

Earnings are primary drivers of idiosyncratic stock returns

Unlike patterns in share prices, patterns in corporate earnings may exist in an efficient market, as speculators cannot trade directly on earnings

In an efficient market, share prices respond quickly to changes in firm’s prospects, while earnings may tend to respond on a delayed basis

Def **earnings momentum**: tendency of earnings changes to be positively correlated

Def **earnings** **surprise**: concept and measure of unexpectedness of an earnings announcement

Def **standardized** **unexpected** **earnings** (**SUE**): measure of earnings surprise

SUE = (EPS - Analyst Consensus EPS Estimate) / (Standard Deviation of Earnings Surprises)

Note: the standard deviation is the vol of numerator

On average, stock prices have been shown to continue to drift in the same direction of SUE even after announcement of quarterly profit figures, meaning stocks with positive earnings surprises outperform the market

Def **post-earnings-announcement-drift**: profit from positive surprises by buying immediately after earnings announcement or selling short immediately after a negative earrings surprise. Note: not exist in perfectly efficient market

### Define net stock issuance, and recognize its potential role in generating ex ante alpha

When a company chooses to reduce its shares outstanding, a **share buyback program** is initiated, and the company purchases its own shares from investors in open market or through a tender offer

Reduced shares outstanding can immediately increase earnings per share, reduce dividends payable, and generate earnings-per-share growth

Def **net stock issuance**: issuance of new stock - share repurchases

Positive or negative net stock issuance is one of the most profitable anomalies

### Define insider trading, and recognize its potential role in generating ex ante alpha

Def **illegal inside trading** involve using material nonpublic information, such as impending merger, for trading without required disclosure

Def **legal inside trading**: performed subject to legal restrictions

## Demonstrate knowledge of the Fundamental Law of Active Management (FLOAM)

FLOAM identifies 2 key components of actively managed investment strategies: **breadth** and **skill**

### Calculate and interpret the key components (i.e., breadth and the information coefficient) of the FLOAM

Def **breadth** of a strategy: number of independent active bets placed into an active portfolio. bet: position in security; independent: statistical lack of correlation between bets; active: relatively short-term nature of the perceived return advantage

Def skill of manager, measured by **information** **coefficient** (**IC**), as correlation between managerial return predictions and realized returns

IC = Correlation (Forecasted Returns, Actual Returns)

An alternative to using Pearson correlation coefficient to estimate IC is to use Spearman rank correlation coefficient

### Describe and determine how the FLOAM can be used to understand changes in the information ratio

FLOAM connects breadth and skill to IR

IR = 20.4 is a measure of return earned by a strategy in excess of a benchmark relative to its tracking error

IR = 20.4 indicates IR is positively related to # securities in portfolio (breadth) and is positively related to degree to which a manager is able to credit the returns of securities in portfolio (IC)

Intuitively, IR is enhanced by additional securities because more independent positions increase diversification and lower risk

Idiosyncratic risk is inversely proportional to square root of # securities

Higher breadth increases IR through lowering risk

FLOAM should be interpreted as an intuitive way to understand changes in IR, rather than a practical tool for computing IR value. That is, the focus should be how IR changes when IR or breadth changes

For example, IR = 0.1, to increase IR to 0.2, the active manager could double his skill (measured by IC), increase breadth by a factor of 4, or some combination of both

There is a trade-off between breadth and information coefficient. Not possible for active manager to increase breadth without decreasing IC at the same time: increasing # bets in portfolio requires acceptance of less attractive opportunities

E.g. manager makes bets each quarter => breadth = 4

### Define nonactive bets, and recognize their role in the FLOAM

Def **nonactive bets**: positions held to reduce tracking error rather than to serve as return-enhancing active bets. In other words, intended to to keep return from straying too much from benchmark, rather than to generate alpha

## Demonstrate knowledge of approaches to implementing anomaly strategies.

### Recognize methods for integrating anomalies using factor models

To integrate a set of anomalies into a single trading signal, manager assigns scores to each stock based on each anomaly. The scores are based on manager’s perception of relationship between returns and variables that manager believes are linked to anomaly

Def **multiple-factor scoring model**: combine factor scores of a number of independent anomaly signals into a single trading signal

There are 2 reasons that equity managers may prefer multi-factor approaches over single anomalies

1) Trading signal based on several anomalies simultaneously should offer improved expected returns, if each underlying anomaly offers increased expected returns and if signals generated by anomalies are not perfectly positively correlated

2) More diversified against risk

### Define pairs trading, and describe the steps involved in constructing the portfolio

Def **pairs trading**: strategy of constructing a portfolio wth matching stocks in terms of systematic risks, with a long position in stock perceived to relatively underpriced and short position in stock perceived to be relatively overpriced

This approach is designed to hedge systematic risks (beta) and exploit patterns in relative idiosyncratic returns (ex post alpha)

First step: to identify pairs of stocks based on fundamental analysis (e.g. same industry, same size) or technical analysis (e.g. very high return correlations), that they believe to have similar systematic risks

Second step: to track price spread or recent return spread between two stocks. when the spread is abnormally wide, the recently outperforming stock is sold short, and the other is purchased, with assumption of mean-reverting

For example, Coke and Pepsi

Successful pairs traders have automated systems constantly searching for abnormal price movements in thousands of pairs, probably trading dozens of pairs each day in reaction to short-term performance divergences

### Discuss the effect of short selling on reducing risk and increasing alpha

Manager is able to rank investment opportunities from most attractive to marginally attractive with some consistency and accuracy

However, manager would not decide to hold a highly concentrated portfolio in only the most attractive opportunities, therefore to add securities for portfolio of diversification

The improvement in risk-return opportunities (i.e. IR) of an investment manager with ability to short sell relative to long-only manager, follows from greater breadth that manager has from flexibility to short sell

### Describe the limits to arbitrage and their effect on market efficiency and investment strategies

Def **limits to arbitrage**: potential inability or unwillingness of speculators to hold their positions without time constraints or to increase their positions without size constraints

Limit 1: in micro-cap stocks, institutional investors may be too large to participate, as $1B fund may find the impact of trading with $50MM cap

Limit 2: restrictions on short selling in some stocks or even in entire markets . in addition, stocks floating recent IPOs or spin-offs may not have shares available to be shorted; some company stocks may be temporarily unavailable for borrowing when exceeds supply of borrowable shares

## Demonstrate knowledge of the three major strategies of equity hedge funds

Three major types of equity hedge funds: short-bias funds, equity long/short funds, and equity market-neutral funds

### Recognize the mechanics of short selling

The mechanics of short selling are quite distinct, and short selling requires special skills and risk management techniques

Short position can lead to unlimited losses

Short selling also raises potential liquidity problems, as the lender of security demands collateral to protect its loan

Lender of security may demand the shares be returned. Short seller must purchase shares in market so that to return to securities lender during a period of turbulence rather than at a time of his choosing.

The returns on short position involves 3 major components

1) Capital gain or loss

2) Dividends

3) Short stock rebate on collateral

6. for example of return of short position: short in XYZ at $50/share, with dividend of $0.30/share each quarter. The current rebate is 1% per year. The dollar return when stock price increases to 51 next year

dollar return = -$1 (on stock increase from $50 to $51) - $1.2 ($0.3 x 4) + $0.5 ($50 x 1%)

### Describe the key characteristics of short-bias hedge funds

Generally maintain a net short exposure to stock market. Trim their short exposures when they anticipate that the stock market is more likely to rise, and go fully short when they anticipate that the stock market is more likely to decline

Challenges: Equity markets typically rise over time due to equity risk premium, so short-bias funds should be expected to rise very little or perhaps even decline in an efficient market

Short-bias funds should be evaluated on performance relative to their negative systematic risk

Short-bias funds can be included in a portfolio with a positive beta for hedging and protection against downside risk, but short-bias funds should not be focal point for generating excess returns

With zero systematic risk, the ex-ante alpha of the combination is its expected return in excess of riskless rate

Combining long-only fund (positive beta) and short-bias fund (negative beta) to generate zero beta portfolios

A negative expected return to short-bias fund may be acceptable if the fund offers a sufficiently negative beta to hedge the positive beta of other funds. The focus of evaluating a short-bias fund should be its returns relative to systematic risk, not fund’s absolute returns

There are reputations and regulatory risks to short selling, which NOT exist in long-only positions. During 2008 crisis, some country restrict short selling, or on some stocks

Regulations may also have or institute an **uptick** **rule** that permits short sellers to enter a short sale only at price that is equal to or higher than previous transaction price of the stock

### Recognize inferences that can be drawn from comparing definable characteristics of short bias hedge funds with their historical stand-alone and portfolio performance

Annualized mean return of short-bias funds is zero, which shows superior stock picking skill given a negative beta to world equities during a time of risking stock prices

Annualized standard deviations of returns for both world equity and short-bias funds were similar and were higher than volatility of returns of overall equity hedge fund index

Strong negative correlation between short-bias funds and world equities

### Describe the key characteristics of equity long/short hedge funds

Equity long/short managers build their portfolios by combining a core group of long stock positions with short sales of stock, or bearish positions in stock index options and futures

Comes in two varieties: quantitative or fundamental

1) Quantitative: use precise, objective models to identify trading opportunities; often focus on technical analysis, but may use fundamental measures in addition

2) Fundamental: fundamental analysis on company’s business prospects, including competition and current economic environment; may visit with management, talk with Wall Street analysts, contract customers and competitors, and essentially bottom-up analysis

Def **sector hedge funds**: equity long/short managers focus on one sector

### Recognize inferences that can be drawn from comparing definable characteristics of equity long/short hedge funds with their historical stand-alone and portfolio performance

Returns of equity long/short funds > overall equity hedge fund index, with similar volatilities and Sharpe ratios

Both equity long/short funds and overall equity hedge fund index performs better than world equities and global bonds

### Describe the key characteristics of equity market-neutral hedge funds

Maintain integrated portfolios designed to neutralize equity market risk, bringing beta risk to zero

Generally neutral to overall stock market, as well as across sectors

Idea is to neutralize market and industry risk and concentrate purely on stock selection in both long and short positions

Equity market-neutral fund seek alpha through security selection (market neutrality, firm-wise risk), while equity long/short managers engaging in market timing

Def **mean neutrality**: a fund is shown to have zero beta exposure or correlation to underlying market index

Def **variance neutrality**: fund returns are uncorrelated to changes in market risk

Generally, equity market-neutral managers follow a three-step procedure in their strategy

1) To build an initial screen of investable stocks

2) To analyze investable stocks to identify those stocks that are attractive candidates for long positions (underpriced) and those for short positions (overpriced)

3) To use a computer program to identify portfolio weights so as to be neutral to overall market as well as potentially neutral across sectors

Note: 1. most equity market-neutral managers use optimizer to neutralize market and sector exposure, however, more sophisticated optimizer attempt to keep portfolio neutral to several risk factors, including size, price-to-earnings ratio, book-to-market ratio, leverage, liquidity, and currency sensitivity

As equity market-neutral portfolios are designed to produce returns independent of market, these strategies are especially sensitive to manager’s stock-picking skill

### Recognize inferences that can be drawn from comparing definable characteristics of equity market-neutral hedge funds with their historical stand-alone and portfolio performance

Volatility of average equity market-neutral fund is extremely low, and reflects primary attraction of strategy

Return is in lower range, with a moderately attractive Sharpe ratio

Lack of strong correlation between equity market-neutral funds and world equities

## Demonstrate knowledge of risk associated with equity hedge funds.

### List major types of risk associated with equity hedge funds

**Equity** **markets**: maintain net exposure to equity markets, whereas short-bias equity funds maintain net short exposure. as such, long/short post losses in bear markets, and short-bias post losses in bull markets

**Quantitative** **vs** **fundamental**: quantitative or black box, models assume stock prices behave according to factor model. If stock prices NOT react as expected, equity hedge may produce a negative alpha. Fundamental rely on judgement of a team, which may or may not add value in a given market

**Concentrated** **positions** **and** **liquidity**: as a risk management tool, a limit on position sizes relative to average daily volume tin a specific stock should be implemented

**Regulatory**: restrictions on short selling can have a substantial impact on equity hedge fund strategies

# Chapter 21: Funds of hedge funds

## Demonstrate knowledge of the benefits and costs of diversification in hedge fund investing.

### Define funds of hedge funds

1. Structure crates two layers of fees: fees of FoF, and fees of underlying hedge fund investments

2. Key is to improve portfolio diversification

### Recognize how indices can serve as valuable tools in constructing hedge fund portfolios and analyzing portfolio performance

1. Modest correlations across hedge fund strategies

2. The largest allocation to single-strategy managers is to equity hedge

### Describe the functions of funds of hedge funds

1. Strategy and manager selection: FoF is responsible for selecting strategies and managers who will implement those strategies

2. Portfolio construction: once strategies and managers selected, decide how much to allocate to each strategy and manager, depending on risk & return, and correlations between funds, as well as other features like lockup period, liquidity, size, and length of manager’s track record

3. Risk management and monitoring: monitor each hedge fund to ensure that ongoing performance profile is consistent with fund’s overall objectives

4. Due diligence: process of monitoring and reviewing the management and operations of a hedge fund manager.

Def **operational due diligence**: process of evaluating the policies, procedures, and internal controls of an asset management organization

### List the benefits to investing in funds of hedge funds

1. Diversification: note not necessary function of number of underlying funds or strategies, as hedge funds are not single securities, rather, they are previous diversified portfolios of securities

2. Accessibility: the median min investment for single hedge fund is: $500,000; while it’s much lower for FoF, which allows more individual investors and small institutions to gain diversified access to HF

3. Economies of scale: investors share costs with FoF co-investors, reducing their individual costs, such as manager selection, reporting, analysis and due diligence process

4. Information advantage: FoF have ability to access, collect, and interpret data from various channels, which provide informational advantage over non-professional investors

5. Liquidity: HF is relatively illiquid due to lockups, potential redemption gates, notice periods, and limited redemption dates. But FoF are typically more flexible, which offers quarterly or monthly liquidity in normal market conditions

6. access to certain managers: most HF are closed to new investments, while investing in existing FoF is fastest way to immediately participate in their performance

7. Negotiated fees: FoF have negotiated access to certain managers at reduced fees

8. Regulation: some FoF choose to register in regulatory jurisdictions that offer better investor protection, to facilitate their distribution to a wider audience

9. Currency hedging: small or private investors prefer to shield from currency fluctuations, and delegate hedging to professional managers

10. Leverage: some FoFs provide leverage to investors

11. Educational role: a way to learn about hedge fund strategies and hedge fund managers. larger investors may switch to direct investments in HF after gaining a few years of experience

### List the disadvantages to investing in funds of hedge funds

1. Double layer of fees: 1% management fee + 10% performance fee on top of 2% and incentive fee of 20% for HF

2. Performance fees not netted: performance fees for each of underlying hedge funds profitable

3. Taxation: tax inefficient for certain investors in certain countries

4. Lack of transparency: some FoFs do not disclose content of their portfolios or their asset allocation

5. Exposure to other investors’ cash flows: FoFs commingle the assets of a number of investors, as such, jointly by inflows and outflows

6. Lack of control: give up how assets are managed

### Evaluate how funds of hedge funds add value

There are essential 3 major ways for FoF to add value for the second layer of fee

1. Through strategic allocations to various HF styles: analyzing long-term risk and return profiles of different strategies, as well as examining correlation of their observed and expected returns

2. Through tactical locations across HF styles: active strategies that seek to enhance short-term portfolio performance by opportunistically shifting the asset allocation in response to changing environment

3. Through selection of individual managers: decision of how much money to invest with each manager

### Discuss and determine the relationship between the number of funds in a portfolio and the level of diversification

Using empirical approach,

1. A broadly diversified portfolio of between 15 and 20 HF can reduce portfolio volatility to level of fixed-income investment

2. A portfolio of 8 HF has 0.5 volatility of a single HF

### Describe the process for identifying funds for an institutional portfolio or a fund of funds

1. HF selection follows the following steps:

1). Universe of 7,000 HF

2). HF database over 4,000 HF

3). Quantitative screens 500 to 1,000

4). Due diligence 100 to 200

5). Fund of funds: 10 to 50 funds

2. Quantitative screens: min length of track record, min returns, max risk, manager capacity

3. Due diligence: most expensive and most challenging, beginning with locating and meeting each HF manager

## Demonstrate knowledge of investing in multistrategy funds

### Evaluate and determine fee-related advantages of multistrategy funds

1. The key advantage of multi-strategy fund over FoFs is lack of explicit 2nd level of fees

2. Most multi-strategy funds charge incentive fee on aggregated returns of combined portfolio of underlying strategies

3. Def **fee netting**: investor pays incentive fees based only on net profits of combined strategies, rather than on all profitable strategies

### Evaluate flexibility and transparency in the context of multistrategy funds

1. Multi-strategy funds have a greater ability to make tactical strategy allocation and risk management decisions

2. Multi-strategy funds have real-time access to all positions, making it easy to identify the exact positions, performance, and risks at all times

3. Recent development in HF is to build their own internal FoFs, which offers several different HF strategies to their investors

### Evaluate potential advantages related to manager selection and operational risk management by funds of funds

1. Multi-strategy fund manager hires a number of trading teams, each of which executes a specific strategy and agrees to have its capital allocation regularly increased or decreased at discretion of portfolio manager

2. Multi-strategy funds have historically outperformed fund of funds on risk-adjusted basis, due to extra layer of fees charged by FoF

## Demonstrate knowledge of the process of investing in funds of hedge funds.

### Identify advantages that funds of funds have over direct hedge fund investments

1. Primary purpose of funds of funds are to reduce idiosyncratic risk of an investment with any one HF manager and to tap potential skill of fund of funds manager in selecting and monitoring HF investments

2. Def **liquidity facility**: standby agreement with a major bank to provide temporary cash for specified needs with pre-specified conditions

3. Empirical evidence indicates the returns to FoF have underperformed broad HF index

### Discuss empirical evidence regarding fund of funds returns and the potential for reduced biases in reported performance

There are several reasons that FoF would give a less biased view of HF performance

1) Survivor bias, arises when returns from dead funds are removed from database

2) Instant history bias is reduced, as FOF count the returns to their investments in single HF from data of investment

3) FoF use actual investment weights, which may better reflect the weights used by typical investors

### Recognize the varying investment objectives of funds of hedge funds

1. Def **defensive funds** are likely to have minimal investments in event-driven and relative value strategies, as these managers prefer to overweight investments in macro, systematic diversified, and short selling funds

### Describe how funds of funds can act as venture capitalists

1. Def **seeding funds**, or **seeders**, are funds of funds that invest in newly created individual HFs, often taking an equity stake in management companies of newly minted HFs

2. Fund of funds is experts at raising capital from investors and structuring new investment vehicles. These complementary needs and skills can form the basis for a seeding relationship, or incubating relationship, between FoF and start-up HF manager

3. The seeding activity of FOF may eventually reach 10 managers across a number of strategies. AT $20MM per manager, the FoF has 200 MM of investor capital placed with underlying managers

4. Number of costs with HF due diligence process. Expensive to subscribe to HF databases, to hire and retain internal staff skilled in manager selection and portfolio construction, and to fund the expenses of visiting and evaluating each HF manager

## Demonstrate knowledge of multi-alternatives and other hedge fund liquid alternatives

### Contrast liquid alternatives with a private alternative investment vehicle, such as hedge funds, CTAs, and funds of funds

1. HF is relatively unregulated, exchange-traded or liquid alternative investments must comply with local regulations, such as 40 Act in US or UCITS in Europe

2. Private placement funds have higher returns and higher risks due to extra freedom allowed in portfolio management process

### Discuss areas where UCITS regulation is more strict than that for private placements

1. UCITS: generally managed as long only stock and bond funds

2. UCITS III 2001: regulations allowed use of options, futures, and other strategies for first time, which open door to offer HF-like strategies

3. UCITS IV 2011: allows fund mergers and master-feeder structures, which gives greater flexibility to HF managers

4. UCITS regulations require reporting of holdings at least every 2 weeks to enable investors to view composition of the funds on a regular basis

5. UCITS in some areas are less flexible than US 40 Act: UCITS not permit investment in property, PE, and commodities

6. Leverage and contraction risks are also tightly controlled in UCITS funds, with leverage and risk typically limited to 200% of NAV

### Discuss restrictions on ’40 Act funds

1. Funds compliant with 40 Act regulations must offer regular liquidity, with redemptions being paid with 7 days

2. Funding holdings must also be disclosed on a regular basis

3. Place limits on fund’s leverage: 300% asset coverage rule, which requires a fund to have asset totaling at least 3 times total borrowing of fund, thus limiting borrowing to 33% of assets. For example, 150% long with 50% short will satisfy, while 200% long and 150% short will NOT

### Compare and contrast relative value hedge funds, event-driven hedge funds, and macro and managed futures funds in the context of the regulatory framework for liquid alternative investments

Four key HF strategies in view of regulatory framework for liquid alternative investments

1. Macro and managed futures funds: broadly available as liquid alternative products, given underlying holdings of futures and forward contracts can be extremely liquid. Funds using 40 Act fund structure can access managed futures returns by holding funds as collateral and entering into swap agreements that transport returns of managed futures into liquid alternative structure.

2. Event-driven HF: focus on corporate events. strategies such as merger arbitrage or activism are likely to comply with liquid alternative regulations, but not broadly available in liquid alternative format. Other strategies, like distressed investing, are likely to be too illiquid to offered in exchange-traded formats.

3. Relative value HF: focus on convertible bond arbitrage and fixed income arbitrage strategies. Generally hold long positions in underpriced bonds and short positions in bonds or stocks meant to hedge the long positions. As the spread is small, it’s managed in leverage much higher than 40 Act regulations. NOT generally available in liquid alternative format

4. Equity HF: long/short equity funds are most popular strategy, with equity market-neutral funds following closely behind. A large number of equity HFs is likely to be compliant with regulatory requirements for alternative investments, even when managed in a private placement structure

Note: liquid alternative space is broader than HF, including funds with exposure to commodities, currencies, and non-traditional bonds

N2: **Nontraditional** or **unconstrained** **bond** **funds**: NOT simply take long positions in investment-grade sovereign and credit securities, but may also invest in high-yield or emerging markets debt, often including leverage and short positions

### Discuss why multi alternatives are popular as liquid alternatives

1. Multi-alternative funds diversify across fund managers and strategies

2. Long/short equity and multi-alternative funds comprise >50% of assets under management within liquid alternatives focused on HF-like strategies

3. Some HF strategies are difficult to manage within leverage constraints of 40 Act. These funds find success within multi-alternative or multi-manager structure, as 40 Act apply to full fund, not to individual strategies: highly levered fixed-income strategies can be mixed with strategies less levered

### Discuss empirical evidence regarding historical returns of liquid alternatives

1. Def **matched-sample tests**: to find subset of funds in which each manager offers both a hedge fund and a mutual fund running similar strategies

2. Liquid alternative funds have lower risks than LP funds that employ the same strategy

3. From a sample of LP and registered funds, equity long/short funds have had similar returns and market exposures across the two fund types

4. During 2008 crisis, liquid alternative funds experienced lower drawdowns than average long-only mutual fund

## Demonstrate knowledge of historical performance of funds of hedge funds

Four categories of funds of funds: maker-defensive, conservative, strategic, and diversified

1. **Market**-**defensive** **funds of funds:** to have underlying and unhedged short positions => generally invest in funds generally engaged in short-biased strategies, such as short selling and managed futures => negative correlations w.r.t. major market indices

2. **Conservative** **funds** **of** **funds**: have underlying hedged positions => tend to seek consistent returns primarily through investing in funds with more conservative strategies, such as equity market neutral, fixed income arbitrage and convertible arbitrage

3. **Strategic** **funds** **of** **funds**: have underlying directional bets => seek superior returns primarily through investing in funds with more opportunistic strategies, like emerging markets, sector specific, and equity hedge

4. **Diversified** **funds** **of** **funds**: broad mix of funds => invest in a variety of strategies among multiple managers

### Recognize inferences that can be drawn from comparing definable characteristics of market defensive funds of funds with their historical stand-alone and portfolio performance

1. risk-adjusted performance of market-defensive funds was excellent, with a Sharpe ratio of 0.61, due to high mean returns and low volatility

2. The skewness and kurtosis were near zero with very low downside risk

3. Slightly positive correlation to world equities

### Recognize inferences that can be drawn from comparing definable characteristics of conservative funds of funds with their historical stand-alone and portfolio performance

1. Low mean returns with low volatility and moderate Sharpe ratio

2. Skewness was extremely negative and kurtosis very high

3. Positively related to world equities, US high-yield bonds, commodities, and global bonds

4. Negative correlations to changes in credit spreads and changes in equity market volatility

### Recognize inferences that can be drawn from comparing definable characteristics of strategic funds of funds with their historical stand-alone and portfolio performance

1. Generally positively related to world equities, US high-yield bonds, commodities, and global bonds

2. Negative correlations to changes in credit spreads and changes in equity market volatility

### Recognize inferences that can be drawn from comparing definable characteristics of diversified funds of funds with their historical stand-alone and portfolio performance

1. virtually indistinguishable from returns of composite funds of funds index, including modest mean returns, low volatility, and moderate Sharpe ratios, as both index indicate overall performance of funds of funds category

2. Negative skewness

3. Positive excess kurtosis

4. Positively related to world equities, US high-yield bonds, commodities, and global bonds

5. Negatively related to changes in equity market volatility and changes in credit spreads

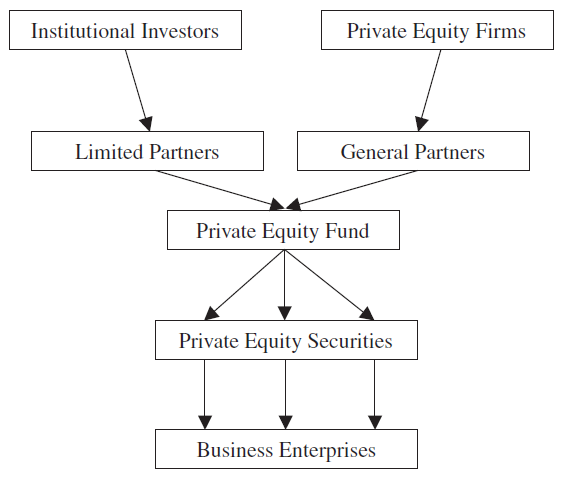
6. Strongest correlation with world stocks

# Chapter 22 Introduction to Private Equity

## Demonstrate knowledge of private equity terminology.

### Recognize the structure of private equity funds and investments

1. Potential confusing aspect of private equity: multiple layers of private equity investments, where 3 main levels of private equity, including manager, investment fund or underlying investment



* Def **vintage** **year**: the particular PE fund commences operation
* Def **Private** **equity** **firm**: used to describe firms like KKR at top level
* Def **private** **equity** **funds**: used to describe limited partnerships such as KKR European fund III at middle level
* Def **private** **equity** **securities**, portfolio companies, or underlying business enterprises: used to describe underlying investments in unlisted business seeking growth, shown at the bottom level
* A private equity firm crates a private equity fund that purchases private equity securities
* Explain the roles of various entities involved in private equity investments
* There are2 major types of PE investments that involves ownership in equity claims: VC and buyout

## Demonstrate knowledge of the major forms of private equity investments that involve direct ownership of equity claims.

* Recognize characteristics of venture capital and its role in business start-ups
* Def **Venture** **capital** (VC): early-stage financing for young firms with high potential growth that do not have a sufficient track record to attract investment capital from traditional sources, like public markets or lending institutions.
* Def **burn rate** of young business: describes the speed with which cash is being depleted through time and can be used to project when the organization will again require outside funding. For example, a company with $30MM of cash has a burn rate of $2MM/month, will need new cash injection in 15 months
* Def **venture capital securities**: privately held stock, or equity-linked securities, that venture capitalist obtain when investing in business ventures that are striving to become larger and to to public: long haul with 5 to 10 years
* Discuss the prudent person standard in the context of venture capital

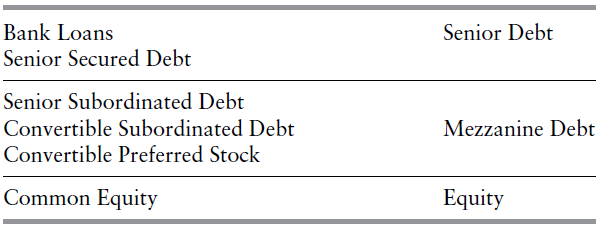
Def **prudent** **person** **standard**: requirement that specifies levels of care that should be exercised in particular decision-making roles, such as investment decisions made by a fiduciary.

The rules were established to ensure competent investment decision-making with regard to the large and growing pension assets and liabilities of US corporations

* Recognize characteristics of buyouts and the role of debt in these transactions
* Def **buyouts**: purchase of a public company by an entity that has a private ownership structure
* Buyouts typically use debt financing, either through bank loans or with newly issued bonds, to purchase the outstanding equity of the target company. Typically, these loans and bonds are secured by underlying assets of company being acquired
* Def **leveraged buyout**: when after the buyout, the debt-to-equity ratio is much larger than before the acquisition. For example, D/E ratio is 9:1, meaning the capital structure of company after buyout is 90% debt and 10% equity
* Recognize characteristics of merchant banking and the benefits it offers financial institutions
* Def **Merchant banking** is very similar to buyouts, where it is the practice whereby financial institutions purchase nonfinancial companies as opposed to merging with or acquiring other financial institutions.
* MB started as a way to establish an equity participation in enterprises they helped fund. If a bank lent money to a buyout group to purchase a company, its merchant banking unit also invested some capital as equity capital and received an equity participation in the deal

## Demonstrate knowledge of the major forms of private equity that involve direct ownership of debt securities

* Describe mezzanine debt, and explain why it is considered a type of private equity investment
* Def mezzanine debt contains both equity-like and debt-like features, as it inserted into company’s capital structure between the floor of equity and ceiling of senior secured debt.
* Typically mezzanine financing is constructed as an intermediate-term bond, with additional enticement to equity kicker
* Def **equity** **kicker**: option for some type of equity participation in the firm



* Def **story** **credit**: a debt issue with credit risk based on unusual circumstances, and may involve special aspects, such as corporate reorganizations
* Discuss distressed debt securities in the context of private equity investing
* Def **distressed debt investing**: practice of purchasing the debt of troubled companies, requiring special expertise and subjecting the investor to substantial risk
* Like other forms of PE, this form of investing requires a longer-term horizon and ability to accept lack of liquidity for a security for which often no trading market exists
* Distressed has 2 meanings: 1. Issuer of debt is troubled => workout, turnaround, or bankruptcy solution to be implemented; 2. Price of the bonds, with pennies on the dollar => requires a savvy investor the opportunity to earn extraordinary returns by identifying a company with a viable business plan but a short-term cash flow problem
* Both hedge funds and PE funds invest in distressed debt. The goal of hedge fund: to earn short-term trading profits from event-driven strategy; PE investors have a longer time horizon.
* Discuss the growth of the distressed debt marketplace
* Def **charge-off loans**: loans of a financial institution that have been sold to investors and written off the books of the lender at a loss
* Reasons of growth of distressed debt marketplace

1. Types of commercial loans available for resale rose
2. More banks and other lenders began managing their assets from a larger portfolio perspective, as opposed to account-level basis
3. Debt loads have generally risen through the years, especially under CCC rating
4. Explosion of covenant-light (cov-lite) loans

* Def **covenant**-**lite** **loans**: loans that place minimal restrictions on debtor in terms of loan covenants
* Explain various types of debt covenants
* Def **negative** **covenants**: promises by the debtor not to engage in particular activities, such as paying dividends or issuing new debt
* Def **positive** **covenants**: promises to do particular things, such as maintain a specified cash level
* Def **incurrence** **covenant**: require a borrower to take or not take a specific action once a specified event occurs. E.g. do test when event happen
* Def **maintenance** **covenants**: stricter than incurrence covenants in that they require a standard be regularly met to avoid default. E.g. do test for a certain frequency, like quarterly
* Discuss leveraged loans in the context of private equity investing
* Leveraged loans is another class of fixed-income securities that PE firms have moved into
* Def **leveraged loans**: syndicated bank loans to non-investment-grade borrowers
* Def **syndicated**: use of a group of entities in underwriting a security offering , or jointly involved in other financial activities
* The word leverage often refers to the use of leverage by borrowers
* Def of leveraged loan varies

1. S&P rating below BBB
2. Loan bears a coupon in excess of 125 to 200 bps over LIBOR

* In many respects, leveraged loans are similar to high-yield debt or junk bonds in terms of credit rating and corporate profile
* Discuss the growth of leveraged loans
* Growth driven by development and expansion of their secondary market
* Many large commercial banks have changed their business mode from a traditional lender, in which bank loans are kept on their balance sheets, to an originator and distributor of debt

## Demonstrate knowledge of liquid alternatives in the private equity sector

* Describe business development companies (BDCs)
* Def **Business development companies** (**BDC**s) are publicly traded funds with underlying assets typically consisting of equity or equity-like positions in small, private companies
* BDCs used a closed-end structure and trade on major stock exchanges, especially NASDAQ
* BDCs are investment companies with a primary purpose of pooling financial assets and issuing pro rate claims against those assets
* The key to investment companies is that they can avoid the double taxation of corporate profits
* To be classified as a BDC, a BDC must provide significant managerial assistance to the firms that it owns and must invest at least 70% of its investments in eligible assets, as specified by SEC
* BDCs enable liquid ownership of pools of illiquid private equity, just as REITs can be used to provide liquid access to illiquid private real estate. The shareholders are subject to income tax on the distributed profits. Any profits retained at the BDC level are subject to corporate income tax. Therefore, most BDCs distribute almost all profits to shareholders to avoid the income tax on retained earnings
* Calculate the premium (or discount) of closed-end fund prices
* BDCs use a closed-end fund investment structure that transforms ownership of underlying fund assets into shares (tradable pro rate claims)
* Closed-end structure facilitates liquid ownership of illiquid pools of assets much better than open-end structure, which requires regular redemption of shares, difficult when holding illiquid assets

Premium (or discount) = (market price / net asset value) - 1

* For example, a closed-end fund reports net asset value of $20 is selling at a 5% premium if the market price is $21.
* Discuss the diversification and return-enhancement potential of liquid private equity pools
* Liquid PE (e.g. BDCs) return vs illiquid PE (e.g. private partnerships) return
* BDCs ETF had high correlations of monthly returns with both SPY and IWM
* The liquid alternatives take on correlations more closely with small caps than with large caps
* Discuss other liquid investments in private equity
* To proxy PE investments by investing in publicly traded shares of PE asset management companies, such as Carlyle, Blackstone, Apollo, Oaktree, or KKR
* Direct exposure can be achieved through listed companies, like Onex, that hold stakes in a large number of private companies

## Demonstrate knowledge of trends and innovations in private equity markets

* Discuss secondary markets in the context of private equity
* There are 3 primary reasons that a PE investor may need to sell part of a portfolio

1. To raise cash for funding requirements: e.g. pension fund to fund retirement benefits
2. To trim risk of investment portfolio: e.g. adjust during crisis
3. To rebalance the portfolio from time to time: e.g. active portfolio management

* GP usually do not like their investors sell their LP interests to outside 3d parties. Therefore, GP is unlikely to invite that selling LP to join in future PE funds that GP sponsors
* From buyer’s perspective, there are several advantages to a secondary purchase of PE LP

1. Gain exposure to a portfolio with different vintage years
2. 2nd interests typically represent an investment with a PE firm further along in investment process than a new private equity fund and may be closer to harvesting profits from private portfolio
3. May be a way for another investor to gain access to future funds offered by GP
4. Buyer may see greater potential for CVs from secondary portfolio than currently primary investments

* Describe private investment in public equity (PIPE), and compare it to other private equity investments
* Def **PIPE transactions**: are privately issued equity or equity-linked securities that are placed outside of a public offering and are exempt from registration. Investors purchase the securities directly from a publicly traded company in a private transaction.
* Public: publicly traded
* Private: cannot trade them in secondary markets for a specified period of time
* The greatest advantage for the issuing company is that it can quickly raise capital without the need for a lengthy registration process, which can take up to 9 months, whereas a PIPE transaction can be completed in just a few weeks.
* PIPEs allow PE firm to gain a substantial stake in company, even control, at a discount
* Recognize advantages that PIPEs offer investors
* With bull stock market of 1990s, PIPEs surged in popularity. The advantages of PIPE deals offer investors the variety of securities can be issued including

1. Privately placed common stock: greater illiquidity, the greater discount on PIPE’s issue price
2. Registered common stock: can acquire a block of stock at a discount to public market price for the registered common stock. Particularly appealing for PE firms with large chunks of cash to commit to companies
3. Convertible preferred shares or convertible debt:
4. Equity line or credit: equity line of credit (ELC) is a contractual agreement between issuer and investor that enables the issuers to sell a formula-based quantity of stock at set intervals of time

* Recognize and compare various types of PIPEs
* Def **toxic** **PIPE**: PIPE with adjustable conversion terms that can generate high levels of shareholder dilution in the event of deteriorating prices in the firm’s common stock
* Def **structured** **PIPE**: more exotic securities, like floating-rate convertible preferred stock, convertible resets, and common stock resets
* Discuss and contrast hedge fund participation in private equity
* There are 6 major differences between typical hedge fund incentive fees and typical PE fund incentive fees:

1. Hedge fund incentive fees are front loaded, while PE tends to collect at termination of deals
2. HF are based on changes in net asset value, while PE based on realized values
3. HF collect on a regular basis, either quarterly or semi-annually, while PE tend to collect at time of an event
4. Investor capital NOT return first to collect incentive fees in HF, while PE NOT distribute incentive fees until the original investor capital has been repaid
5. HF have no provisions for clawback of management or incentive fees, while PE typically has clawback provisions
6. HF rarely have a preferred rate (hurdle rate) of return (e.g. 6%), while PE have a hurdle rate

# Chapter 23: Equity Types of Private Equity

## Demonstrate knowledge of the relationships between venture capital and leveraged buyouts.

* Recognize the role of venture capital and leveraged buyouts as sources of funding for corporations through their life cycle
* Corporations tend to experience three stages in their lives: a start-up stage, a growth stage, and a stable or mature stage
* Start-up companies: generally have a new or innovative technology, exploited with right amount of capital
* VC relies on new technology or innovation, while buyouts look to see where they can add operating efficiencies or expand product distribution.
* Buyouts take an existing product and refine it through improvements to the production process or by developing new distribution channels or expanding existing ones

## Demonstrate knowledge of the underlying businesses (portfolio companies) of venture capital

* Recognize characteristics of businesses underlying venture capital investment
* The foundation of VC is the underlying start-up businesses and the entrepreneurs who create and build them. Venture capitalists provide financing for these businesses using their own capital and the capital of their investors. Once they invest in a company, they take an active role either in an advisory capacity or as a director on the board of the company
* List the types of securities used in venture capital
* VC usually invest in convertible preferred stock of start-up company, which are favored manner of investment as they are senior to common stock in terms of dividends, voting rights, and liquidation preferences. Plus, VC have option to convert their shares to common stock when exiting via IPO
* Other investment structures include convertible notes or debentures that provide for conversion of principal amount of note or bond into either common or preferred shares at option of VC
* Explain why venture capital investing is similar to purchasing a call option
* The price of the option is the capital that the venture capitalist invests in the start-up company, where gone if failed, but up to very good upside gains, like 20-bagger (20-fold compared to cost of VC investment)
* Def **20-bagger**: company that appreciates in value 20-fold compared to cost of VC investment
* Describe the role of business plans and exit plans in venture capital investment

How does a VC select investments in start-up?

1. **Business** **plan** of entrepreneur, which clearly state business strategy. It has 2 key objectives: 1. To provide information necessary to attract financing from a VC; 2. To serve as an internal game plan for the development of start-up company
2. **Exit plan:** describes how VC can liquidate their investment in start-up company to realize a gain and their investors

## Demonstrate knowledge of venture capital funds

* Define a venture capital fund
* Def **VC** **fund**: PE fund that pools capital of large sophisticated investors to fund new and start-up companies. Each VC fund is managed by a GP, who is typically the VC firm that raised the capital for the fund. The GP sources investment opportunities, review business plans, performs due diligence and takes a seat on board of directors of start-up company
* Recognize how venture capital fund managers raise capital
* Before investing money with start-up ventures, VC fund manager must go through a period of fund-raising with outside investors
* Def **gearing**: increase risk through leverage
* Recognize the terms of the partnership agreement of venture capital funds
* Limit on the amount of private investments the VC fund manager can make on its own in any of the firms funded by VC fund
* Limited in their ability to sell their GP interests in VC fund to a 3rd party
* Restriction on amount of future fund-raising
* GP spend substantially all of the time managing the investments of fund, where outside interests are limited or restricted
* Describe typical venture capital fund fee structures
* **Management** **fee**, ranging from 1% to 3.5%, with most VC funds 3% to 2.5%, based on committed capital, the cash investment promised by an investor. For example, $100MM committed capital with $50 MM invested. The management fee should be based on $100MM
* **Incentive** **fee**:
* Def **capital** **calls**: options for manager to demand that investors contribute additional capital

## Demonstrate knowledge of the dynamics of investing in venture capital

* Describe the stages of the life cycle of venture capital funds and portfolio companies

Stage 1: **fund-raising stage**, where VC firm raises capital from outside investors; capital is committed, but not collected. The VC firm or GP also posts a sizable amount of committed capital; it takes about 6 months to 1 year

Stage 2: **sourcing investments**: the process of locating possible investments (i.e. generating cash flows), reading business plans, preparing intense due diligence on start-up companies, and determining attractiveness of each start-up company; this period begins when closed to investors; usually takes 5 years

Stage 3: **investment of capital**: VC manager determines how much capital to commit to each start-up company, at what level of financing, and in what form of investments (e.g. convertible preferred shares, and convertible debentures)

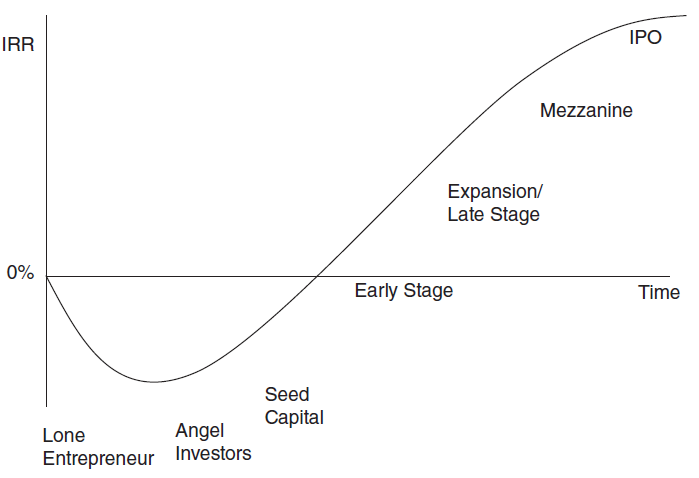
Stage 4: **operation and management of portfolio of companies**: begins after all the funds have been invested, and lasts almost to end of the term of VC fund. Managers work with portfolio companies where VC fund has invested.

Stage 5: **windup and liquidation**: harvesting stage, where each portfolio company faces 3 outcomes: sold to a strategic buyer, brought to IPO, or liquidated through a bankruptcy liquidation process; profits are distributed to limited partners, and GP now collects incentive fees.

Note: investors bare loss for the first 3 to 5 years of VC fund’s life

1. those investments that fail quickly are posted as losses, while investments that are showing excellent potential are not posted as profits (not yet sold)
2. draw annual management fees based on total committed capital
3. organization expenses

Note: the life cycles of portfolio companies often follow **J-curve**, which is the classic illustration of early losses and later likely profitability of VC.



The J-curve shows loss and negative IRRs during early life of a portfolio company

* Explain the importance of financing stages in distinguishing among various venture capital funds

The most distinguishing char of VC firms is stage of financing. In all, there are 5 discrete stages of VC financing

1. **Angel investing**: earliest stage of VC, where investors fund the first cash needs of an entrepreneurial idea;

* Only just an idea, no formal business plan, no management team, no product, no market analysis;
* Often comes from friends and family, or wealthy individuals who dabble in start-up companies
* The task of entrepreneur is to begin development of prototype product or service; begins to draft business plan, assessing market potential, and assembling some key management team members; no marketing or product testing is done at this stage
* The amount it typically small: $50K to $500K

1. **Seed** **capital**: first stage where VC firms invest their capital into a venture, prior to having established viability of product.

* At this stage, business plan completed and presented to VC firm; some management team have been assembled; entrepreneur and small team have performed a market analysis and addressed other parts of business plan
* Financing is provided to complete product development and possibly begin initial marketing of prototype to potential customers
* A prototype is developed and product testing begins; Def beta testing: prototype is sent to potential customers free of charge to get their input into product’s viability, design, and user-friendliness
* Typical financing: $1MM to $5MM
* Revenue is very little, if any; company not profitable;
* Seed capital VC firms are not numerous, so entrepreneur might have to reply on angel investors as well

1. **First** **stage** (or **early** **stage**) **VC:** the start-up company should have a viable product that has been beta tested

* Begin testing of second-generation prototype with potential end users
* VC denotes funding after seed capital but before commercial viability has been established
* Revenues are being generated, and the product or service is now demonstrating its commercial viability
* Typical financing: $2MM
* Financing used to build out commercial-scale manufacturing services
* The company is now going certain with an initial management team
* At least one VC capitalist is sitting on board of directors
* The business and marketing plans are refined, manufacturing has begun and initial sales have been established
* The goal of VC is to achieve market penetration with its product; distribution channels should be identified by now; reaching financial break-even point is the financial goal

1. **Second** **stage** (**late**-**stage**) **expansion** **VC**

* Start-up may have generated its first profitable quarter or be just at the point of breaking even
* Commercial viability is now established
* Cash flow management is critical at this stage; 2nd stage VC fills the cash flow deficiency once commercial viability is established; VC financing is also used to help get through cash crunch (VC financing help); additional capital is used to tap into distribution channels, establish call centers, expand manufacturing facilities, and attract additional management and operational talent necessary to make start-up company a longer-term success
* Typical financing need: $5Mm to $25MM
* The future of start-up is bright, but working capital is short; sales are snowballing and receivables are growing, but receivables have not yet translated into a solid and stable cash flow
* Market penetration has been established, and company has met some initial sales goals; a break-even point has been achieved and the company is starting to generate profits, though cash is still lagging

1. **Mezzanine** **financing (or Pre-IPO financing):** last funding stage before going public or sold to strategic buyer.

* 2nd generation production may already be in production, if not distribution
* The management team is together and solid, and the company is working on improving its cash flow management
* Manufacturing facilities are established, and company may already be thinking about expanding internationally
* Typical financing: $5MM to $25MM, considered bridge or mezzanine financing to keep company from running out of cash till IO or strategic sale
* Company is a proven winner with an established track record; may have a large inventory of uncollected accounts receivable that need to be financed in short term; profits are being recorded, but accounts receivable are growing at the same rate as sales
* Mezzanine financing may be in the form of convertible debt; start-up may have sufficient revenue and earning power to qualify for a traditional loan => start-up may have to clean up its B/S and statement of cash flows
* Commercial viability is more than just generating sales, requiring turning accounts receivable into actual dollars
* Explain the compound option that is embedded in most venture capital investments

Money invested in each of these stages of a venture can be viewed as the purchase of a call option on investing in the next stage of the venture, which in turn is a call option. For example, consider a project requiring 100K angel capital and expect last one year with potential receiving $2MM seed capital; if successfully deployed, the seed capital may lead to early-stage financing of $5MM, which in turn could lead to later stages with higher capital requirement. In this example, the very first investment of 100K, it is the premium of first option on project with expiration of 1 year and strike of 2MM. If the option is exercised, VC acquires another option costing $2MM, with a strike price of $5MM.

Note: the VC may explicitly state the specified operating goals of the firm that must be met before more funds are invested in the venture

Note: An option expiration date is the point in time at which either additional capital has to be invested or the project is abandoned or sold

Note: The compound option view clarifies the keys to successful VC investing

1. Identifying underpriced options by locating potentially valuable projects, substantial info can be obtained prior to commitment of substantial capital
2. Abandoning out-of-money options when expiring by ignoring sunk costs, and judiciously assessing likely outcomes of success based on objective analysis of new information

* Discuss the concept of the J-curve in the context of a start-up company

## Initial years: reported accounting-based loss, with turning into a prototype product and beta testing the product with potential customers; little or no revenue is generated

Additional rounds of financing may be needed to get company to generate cash and profit. Once critical mass is achieved – when products are sold, sales are turned into profits-the company turns a profit using traditional accounting => higher range of profits on J-curve

IRRs, except for rightmost IRR, are generally computed as interim IRRs, where each interim IRR is therefore based on nonmarket value (net asset value) estimated at that point in time. These interim values may be biased downward due to conservative accounting standards.

## Demonstrate knowledge of the risk and return characteristics of venture capital investments

* Describe the main risks of venture capital investments

1. Business risk: company may fail
2. Liquidity risk: no liquid public market for trading VC interests. The tailored nature of VC’s holdings is unlikely to appeal to more than a very selected group of potential buyers
3. Idiosyncratic risk: due to lack of diversification associated with VC portfolio.

* Describe return persistence and vintage-year diversification as keys to successful venture capital investment

Two important keys to successful VC investing by institutions are

1. Accessing top-tier VC managers (boosting returns): superior performance in a PE firm’s most recent funds is usually viewed as a predictor that the firm’s next fund will also generate superior performance. Quite a bit of this performance persistence can be explained by reputation of GP managing VC fund
2. Achieving vintage-year and industry diversification (reducing risk): reflecting tendency of VC to follow a cycle of boom and bust

* Recognize inferences that can be drawn from comparing definable characteristics of venture capital investments with their historical stand-alone and portfolio performances

General PE performed very well over 15-year period with high average annual returns (11%) and moderate risk => high Sharpe ratio relative to major market indices

High autocorrelation coefficient indicates potential smoothing of returns, which raises concerns of risk under-estimation, especially based on non-market price data

VC underperformed other indices while exhibiting moderate to substantial risk

Positive exposures of both PE and VC returns to returns of world equities, negative exposures to commodity returns, equity volatility, and credit spreads

## Demonstrate knowledge of types of buyout transactions.

* Distinguish leveraged buyouts (LBOs) from traditional investments

1. LBO buys out control of assets
2. Uses leverage
3. NOT publicly traded

Most LBO transform the target company from publicly traded to highly leveraged PE; LBOs are distinguished from mergers and acquisitions that typically fold the structure and operations of target firm into acquiring firm.

* Describe a management buyout (MBO)

Def **MBO**: buyout led by target firm’s current management

The control of new company is concentrated in hands of buyout firm and the target company’s management, and there are no public shares left outstanding

The goal of buyout: to increase value of a corporation by unlocking hidden value, max borrowing capacity, taking advantage of tax benefits of using debt financing, and exploiting existing but under-funded opportunities

* Contrast a management buy-in (MBI) with a buy-in management buyout, and describe the agency issues of buyouts

Def **MBI**: type of LBO where buyout is led by an outside management team and control of new company is taken over by new (outside) management team, and the old (incumbent) management team leaves.

Def **buy**-**in** **management** **buyout**: hybrid between MBI and MBO where new management team is a combination of new managers and incumbent managers

Secondary buyout is increasingly important sector of buyouts. In a secondary buyout, one private equity firm typically sells a private company to another PE firm. In effect, a secondary buyout is typically an ownership change among PE firms. It provides a second-market opportunity for PE firms to exit a buyout.

## Demonstrate knowledge of leveraged buyout (LBO) transactions

* Describe the structure of LBO funds and the role of various entities involved in LBO transactions

Almost all LBO funds are structured as LP. LBO funds are run by a GP, typically an LBO firm.

Some LBO funds have advisory boards composed of GP and a selected group of LP. The duties of advisory board are

* to advise the GP on conflicts of interest that may arise as a result of acquiring a portfolio company or collecting fees
* to provide input as to when it might be judicious to seek independent valuations of LBO fund’s portfolio companies
* to discuss whether dividend payments should be in cash or in securities

PE funds have contractually set lifetimes, typically 10 years, with provisions to extend the LP for 1 to 2 more years.

* Describe typical LBO fund fee structures

LBO firms have numerous ways to make money, and LBO firms are masters of universe when it comes to fee structures.

1. Annual management fees, 1.25% to 3% of invested capital
2. Incentive fees, or carried interest, 20% to 30% of total profits
3. Fees of up to 1% of total selling price to corporation it is taking private. GP keep all these fees, rather than sharing with LP
4. Divestiture fee for arranging the sale of a division of private company after buyout has been completed
5. Directors’ fees to a buyout company if managing partners of LBO firm sit on company’s board of directors after buyout has occurred

* Calculate LBO fees

For example, assume a PE firm raises a $10B buyout fund and charges a management fee of 1.5%, or $150MM each year for life of fund. Assuming 10-year life and 8% discount rate, it’s $1.006B fees

* Describe agency relationships, their associated costs, and their role as a potential source of return to LBO transactions

The objective of senior management may be very different from those of a public corporation’s equity owners. For example management may be concerned with keeping their jobs and presiding over a large empire. Conversely, shareholders want value creation (i.e. share price maximization)

Agency cost come in two firms

1. Cost to properly align management’s goals with value-creation goal of shareholders, including cost of monitoring management, shareholder review of management perquisites and independent review of management’s compensation structure
2. Erosion of shareholder value from managerial actions NOT in best interests of shareholders. After a company is taken private, LBO firms maintain an active role in guiding and monitoring management of company; LBO firm managers are active, not passive, shareholders.

* Describe general categories of LBO transactions and how they create value

1. **Efficiency** **buyouts**: LBO that improves operating efficiency. Often lead to reduction in firm assets and revenue with goal of eventually increasing frim profits => more concentrated ownership and better incentive scheme to mitigate agency problems
2. **Entrepreneurship** **stimulators**: LBOs that create value by helping to free management to concentrate on innovations. One frequently used strategy focuses on unwanted or neglected operating division
3. **Overstuffed** **corporation**: One of the main targets of many LBO firms is conglomerates. An LBO can be used to dismantle inefficient conglomerates, shut down or sell inefficient operations, and allow profitable divisions to reinvest and meet their growth potential.
4. **Buy**-**and**-**build** **strategy**: LBO value-creation strategy involving synergistic combination of several operating companies or divisions through additional buyouts. LBO firm begins with one buyout and acquires more companies and divisions that are strategically aligned with initial LBO portfolio company
5. **Turnaround** **strategy**: LBOs look for underperforming companies with excessive leverage or poor management.Traditional buyout firms often look for successful, mature companies with low debt-to-equity ratios and stable management. The targets for turnaround LBO specialists come from two primary sources: (1) ailing companies on the brink of bankruptcy, and (2) underperforming companies in another LBO fund’s portfolio.

* Discuss the characteristics of portfolio companies of LBO funds

Typically invests in 10 to 30 portfolio companies, with approximately 2 to 6 companies each year

Leveraged buyout funds distinguish themselves by size of companies they take private

* Explain the appeal of a leveraged buyout to managers and investors of the target firm

From view of target firm’s corporate management, the benefits to those who are retained:

1. Use of leverage where interest payments are tax deductible
2. Less scrutiny from public equity investors and regulators
3. Freedom from distracted (and potentially distracting) corporate parent
4. Potential of company management to become substantial equity holders and thereby benefit directly from building the business

* Describe the call-option characteristics embedded in potential payouts of a leveraged buyout

Company has equity of $500MM and debt of $100MM, with EBITDA of $80MM. an LBO fund uses $700MM to purchase the equity of company and payoff outstanding debt. $600MM is offered to equity holders. $700MM LBO is financed by LBO fund with $600MM in debt at 10% coupon rate and $100MM in equity => Company must pay $60MM in annual debt service to meet its interest payments obligations.

After management improves operations, streamlines expenses and implements better asset utilization. After 7-year point, assuming forward-looking growth rate of 2% per year and a discount rate of 12%, the value using constant dividend growth model with annual cash flows of $120MM

$120MM/(0.12-0.02) = $1.2B

Under these assumptions, LBO fund can own $1.2B with equity investment of only $100MM. the total return on investment for LBO:

($1.2B/$100MM)1/7 -1 = 42.6%

A simplified LBO as being financed with a combination of debt and equity, with debt being the large majority of financing

* Describe typical exit strategies of LBOs

1. Sale to a strategic buyer: most common strategy
2. IPO
3. Another LBO: refinanced by the current owners using another LBO deal
4. Straight refinancing: company takes on debt to pay out a large cash distribution to its equity owners
5. Buyout-to-buyout deal: takes place when a PE firm sells one of its portfolio companies to another buyout firm

* Describe the concept of spillover of corporate governance to the public markets

Four important benefits for the public market

1. Strong governance principles that an LBO implements in its private firms should remain when those firms are taken public again
2. LBO transactions serve as a warning to the management team of other public companies
3. Incentive and monitoring schemes implemented by LBO firms for their portfolio companies provide guidance to managers and shareholders of other firms searching for more efficient governance methods
4. Conglomerates can be popular targets for LBO firms, and this can help stop unnecessary and inefficient diversification of large corporations

* Explain auction markets and club deals as alternatives to the single-sourced approach to funding LBO transactions

Now when a parent company decides to sell a subsidiary in an LBO format, it almost always hires an investment banker to establish an **auction** **process**

**Club** **deals**: the large inflow of capital into the private equity market and the increasing market capitalization of firms targeted for LBOs have forced LBO firms to work together in so-called clubs. In a club deal, two or more LBO firms work together to share costs, present a business plan, and contribute capital to the deal.

* Discuss why LBO funds tend to have less risk than venture capital funds

1. LBOs purchase public companies that are considerably beyond their IPO stage
2. LBO firms tend to be less specialized than venture capitalists: greater diversification
3. Eventual exit strategy of a new IPO is much more likely for an LBO than for a VC deal

# Chapter 24: Debt Types of Private Equity

# Chapter 25: Introduction to Structuring

## Demonstrate knowledge of financial structuring.

### Discuss the relationship between financial structuring and the capital structure of the corporate form of a business organization

1. Def **structuring**: process of engineering unique financial opportunities from existing asset exposures

2. Structuring attributes to return, risk, taxation, liquidity

## Demonstrate knowledge of the major types of structuring

### Explain the idea behind tranches

Def **tranches**: partition risk of a portfolio into ownership claims, which offers seniority

### Discuss two examples of tailoring structured products

1. Structured products can be used as an umbrella term to describe a spectrum of innovative financial instruments, specially tailored securities that are financially engineered to provide specific attributes to meet preferences of one or more investors

2. Eg: security paid an investor greater amounts of money if value of XYZ equity performed poorly and lower amounts if performed well, but had a min value to payout => this security may be ideal for investor with a very large position in XYZ stock, trying to avoid selling that position due to potential tax liabilities from a sale. The investor desires downside protection, while retaining some upside potential

## Demonstrate knowledge of the primary economic role of structuring.

### State the primary direct motivation of the issuer

1. Motivation of issuer: to earn fees, either explicit fees or implicit fees

2. Motivation of buyer: risk management, tax minimization, liquidity enhancement

3. View of financial economist: role of structured products is usually market completion

### Discuss how market completion is a motivation for structuring

1. Def **complete market**: financial market where enough different types of distinct securities exist to meet the needs and preferences of all participants

2. Def **completing the market**: being brought one step closer to completion by offering investors unique opportunities with which to manage their finances

### Define state of the world

1. Def state of world, or state of nature (or state), is a precisely defined and comprehensive description of an outcome of the economy that specifies the realized values of all economically important variables

2. Eg: equity market index close at $X, a bond market index closes at $Y, the GDP of a nation $Z, and so on

### Discuss how structured products are market completers

1. The primary role of structured products is to move them toward being more complete

2. for risk management purpose: seek products offer high payoffs in those states where investor’s wealth would otherwise be low

3. for return enhancement purpose: seek products offer high payouts in states unusually likely to occur

4. In both cases above, structuring of products serves economic role of meeting needs and preferences of these investors by completing the market

5. Major Banks, insurance companies, and other financial institutions offer structured products tailored to needs of individuals and institutions for risk management or risk enhancement purposes

## Demonstrate knowledge of collateralized mortgage obligations (CMOs).

### Describe the primary difference between CMOs and other investment pools

Major difference: CMOs use extensive structuring. Specifically, CMOS are financed with security classes or tranches that have substantially varied characteristics

### Describe sequential-pay CMOs

1. Def sequential-pay collateralized mortgage obligations: simplest form of CMO, where each tranche receives a pre-specified share of interest payments based on each tranche’s coupon and principal amount

2. When there is no default, the seniority to principal payments is the focus of CMOs

3. The senior tranche receives all principal repayments until the tranche’s face value has been fully repaid

4. As a tranche’s principal is paid down, its receipt of coupon payments is proportionately reduced

5. A tranche matures once it has received repayment of its entire principal value. The next senior tranche then receives the entire principal payments till it matures

### Define extension and contraction risk

1. Def **extension risk**: dispersion in economic outcomes caused by **increase** in longevity of cash flow stream

2. E.g. lower interest rates, prepayment rates fall => life of most tranches is extended => increase expected life of tranche further than originally expected

3. Most CMO tranches, extension lowers the value <=> similar to lower fixed income instruments value when IR rise

4. Some tranches may benefit from extension, where this fund may fall in value due to contraction when longevity declines

5. Def **contraction risk**: dispersion in economic outcomes caused by **decrease** in longevity of CF stream

6. Eg: consider a CMO with underlying collateral pool of mortgages that generate $1,620,000 cash flow in first month: $1,500,000 in IR and $120,000 in principal. In the first month, both tranche A and tranche B receive their IR payments: 150,000,000x8.5%/12 = 1,062,500 for tranche A; and 50,000,000x10.5%/12 = 437,500 for tranche B, for a total of 1,500,000 IR payments. The remaining CF of 120,000 is principal repayment received from underlying collateral, and it is used only to pay principal to tranche A.

7. The principal for tranche B start to be paid off only after principal for tranche A has been fully paid. The prepayment rates of mortgages underlying CMO increases, tranche A would be paid off faster, and tranche B would start to amortized earlier.

8. In actual CMO structures, there is typically an accrual tranche, or **Z-bond**, that receives no promised interest or coupon payments. Rather, the tranche serves as a residual, equity-like claimant, with rights to cash flows that remain after all fixed-income tranches have been satisfied

### Identify and describe other types of CMO structures and tranches

1. **Planned amortization class** (**PAC**): high priority for receiving principal payments, as long as prepayment rates are within a pre-specified range (planned prepayment levels). Note: a tranche may have high priority to receiving principal payments in one range of prepayment speed and low priority if other prepayment speeds occur. PAC tranches can be riskier and more complex to analyze

2. **Targeted amortization class (TAC)**: receive principal payments in a manner similar to PAC tranches but generally with an even narrower and more complex set of ranges. TAC tranches can be especially complex and risky.

3**. principal-only (PO)**: receive only principal payments from collateral pool, where IO tranches receive only interest payments from collateral pool. PO tranches are **positively** exposed to extension risk, as their values decline when prepayments slow, as they receive no coupons. IO tranches are positively exposed to contraction risk, as their value decline when prepayment accelerate, since their payments are only interest. The prepayment sensitivity tends to severe for POs and Its, with one generally profiting when the other suffers.

4**. Floating rate:** earn IR linked to IR index, such as LIBOR, usually used to finance collateral pools of adjustable-rate mortgages

5. Def inverse floater tranche: coupon increases when IR fall, and decrease when IR rise.

### List the two motivations for structured mortgage products

1. Risk enhancement: can lower risk by selecting tranches with durations that match duration of their liability stream. Investors may be better able to manage risk through structured products

2. Return enhancement: better able to establish positions that will enhance returns if investor’s market view is superior

### Discuss how interest rates and prepayments impact the valuation of a CMO

1. Suppose increased IR lead to 1% drop on overall mortgage values, long term, highly sensitive tranches might drop by 5% or more, while very short-term tranches may be virtually unaffected. IO tranche might even gain in value

2. TAC, IO, and PO tranches can be especially sensitive to IR and prepayment speeds

### Discuss the role of CMOs in the financial crises of 1994 and 2004

US financial crisis involving CMOs on insured residential mortgages in 1994, where IR rose dramatically, causing most CMO tranches to extend in maturity as prepayment rates fell. The combination of extended maturities and higher IR caused market values of most trances to fall, some quite severely.

2. The worst case involves inverse-floating TAC tranches, where some tranches are offered high coupons and expected to mature within months end of 1993, due to high prepayment rates and low IR. However, as part of a TAC structure, the tranches could experience dramatic shifts in seniority to principal payments if prepayment rates deviated from target ranges. Early 1994, prepayment speeds dropped, so some TAC tranches extended from several months to many years, switching from most senior to least senior tranches. Further, in the case of inverse floaters, the coupon fell from high coupons to zero coupons as LIBOR skyrocketed

3. In both 1994 and 2007 crisis, structured products contributed to incased systematic risk, substantially harming or even bankrupting major financial institutions and increasing uncertainty throughout financial markets

4. The power of structured products has generated tremendous benefits. the long maturity and substantial prepayment risk of insured residential mortgages make unstructured ownership of mortgages undesirable to most market participants

5. Structured mortgage products allow market participants to select longevities and risk exposures that more closely align with their preferences. Such that, shorter-term fixed-income money managers can purchase short-term senior tranches, and longer-term managers, such as pension funds, can focus on longer-term tranches of insured mortgages

### Describe commercial CMOs and their default risk

1. For CMOs with underlying portfolios of commercial mortgages or subprime residential mortgages, the primary risk is usually default risk

## Demonstrate knowledge of the structural approach to credit risk modeling

### Recognize the option-like nature of structured cash flows

1. Def **structural credit risk models**: use option theory to explicitly take into account credit risk and the various underlying factors that derive the default process

### Recognize the intuition of Merton’s structural model

1. Assume a levered operating firm has only 2 securities: single issue of zero-coupon debt and single class of equity

2. Call option view of capital structure: views the equity of a levered firm as a call option on assets of firm.

3. Equity of levered firm = call option on firm’s assets

4. Owning debt is equivalent to owning a covered call, meaning being long assets and short a call option on those assets

### Apply the call-option and put-option views of capital structure

1. The **put option view of capital structure**: views equity holders of a levered firm as owning firm’s assets through riskless financing and having a put option to deliver those assets to the debt holders

2. Risky debt of a levered firm = riskless bond - put option on firm’s assets

3. The put option reflects the ability of equity owners to declare bankruptcy and enjoy limited liability

### Discuss the inherent conflict of interest between stockholders and bondholders

1. Inherent conflict between stockholders and bondholders w.r.t. optimal level of risk for firm’s assets

2. Equity holders, with long position in call option, prefer higher levels of risk, especially firm’s assets near or below face value of debt

3. Similar to the case of structured products with multiple tranches

4. Manager of collateral pool can cause wealth transfers between tranches by altering the risk of assets

5. Merton’s view: Asset = [Call] + [Riskless Bond - Put]

6. [Call] represents the equity; [Riskless Bond - Put]: represent firm’s risky debt

7. The equation indicates that for every dollar equity increases in value, the firm’s risky debt must fall in value by $1. The decline in value of firm’s debt is captured as an increase in value of put option.

### Describe how the Black-Scholes option pricing model can be used to estimate the value of debt that contains credit risk

1. Estimate volatility of XYZ’s equity: historical stock vol, implied vol, or combination of two

2. Unleveling XYZ’s estimated equity vol (from step 1) based on XYZ’s capital structure:

3. Solve for price of a call and put on firm’s assets: asset vol can insert into BS formula to derive call and put option prices

4. Use call price as XYZ stock value, and subtract put price from price of riskless bond to value XYZ’s debt

Note: accuracy of estimate option values may be reduced to assumptions of the model. 3 assumptions are very troublesome

1. Percentage changes in values of firm’s underlying assets through time are lognormal distributed

2. Vol of firm’s assets can be accurately estimated

3. A single issue of debt with no coupon

### Discuss binomial tree models as an alternative to the Black-Scholes option pricing model

1. Binomial tree models are extremely flexible and valuable tools for analyzing assets with embedded options

2. Value of credit-risky securities in a capital structure or structured product can be estimated using two underlying binomial trees:

1) Value of assets

2) IR

### Discuss advantages and disadvantages of structural credit risk models

Two major potential advantages

1. Tends to rely on data from equity markets, such as observed stock price volatilities or implied stock price volatilities backed out of option prices. Equity market provide more reliable information, as it is more liquid and transparent

2. Well suited for handling different securities of the same issuer, including bonds of various seniorities and convertible bonds

Three major disadvantages

1. When equity prices are highly unreliable, estimates of asset volatility and values are also highly unreliable

2. Current data on firm’s or structure’s liabilities may be unreliable and in case of sovereign issuers, may be unworkable

3. Valuations generated by simple structural models are sometimes unreasonable, especially for short-term, very high-quality debt and for debt near default

## Demonstrate knowledge of the concept of structuring cash flows using collateralized debt obligations (CDOs).

### Define and explain various tranches of a CDO

1. Def CDO: structure into multiple claims (securities)/tranches

2. The use of structuring to create multiple security types in alternative investing centers on CDOs

3. In simplest form, a CDO is a collection or portfolio of assets financed with multiple securities (or tranches) that differ in regard to their seniority

4. The first priority of cash flows is to meet direct expenses and fees for operation and management of CDO

5. Cash flows are then distributed to various tranches in order of their seniority

6. The default loss will be absorbed with equity tranche first, then middle tranche, and then senior tranche

### Discuss attachment points and detachment points

1. Def **lower** **attachment** **point** (or attachment point): the first percentage loss in collateral pool that begins to cause reduction in tranche

2. Def **upper** **attachment** **point** (or detachment point): higher percentage loss point at which the given tranche is completely wiped out

3. For example, mezzanine tranche has a lower attachment point 10% and upper attachment point of 30%

4. the most senior and most junior tranches in a CDO can be viewed using positions in either a call or a put