LECTURE 17: RISK AND DIVERSIFICATION

I. STUDENT LEARNING OBJECTIVES

A. Risk aversion
B. Investment implications of risk aversion
C. Standard deviation as a measure of risk for individual securities and portfolios
D. Security correlation and portfolio risk
E. Benefits of diversification
F. Efficient diversification and modern portfolio theory

II. RISK AVERSION

A. Risk is the danger of possible loss
   1. People need an incentive to accept risk
   2. Utility of wealth
      a. The value of one more dollar of income
      b. Decreasing marginal utility assumed.
B. Risk-Averse investor
   1. utility function decreases at an increasing rate
C. Risk-neutral investor
   1. utility function increases at a constant rate
D. Risk-taker investor
   1. utility function increases at an increasing rate

III. RISK AVERSION AND EXPECTED RETURNS

A. Higher risk should expect higher returns
   1. T-bills average 3.7 %, range 0 to 5%
   2. S&P 500 average 12.3 %, range -10% to +30%
B. Measuring holding period returns
   1. - Single holding period return (e.g., 1 year)
IV. MODERN PORTFOLIO THEORY (H. MARKOWITZ)

A. The expected return of a portfolio is a weighted average of the expected returns of each of the securities in the portfolio

B. The weights (Xi) are equal to the percentage of the portfolio’s value which is invested in each security

C. The variance of a portfolio is more complex; it is a weighted average of the variances of each security and the correlation between each pair of securities

D. The covariance of historical returns from any pair of securities is measured by the following formula:

E. Notice the similarity between the equation for the Cov(A,B) and the equation for the Var(A)

F. The following conclusion can be drawn:
   1. When the holding period returns of two securities move in the same direction, by the same amount at the same time, the pair is perfectly positively correlated
   2. When the holding period returns of two securities are totally unrelated to each other, the pair is uncorrelated
   3. The risk of a portfolio is the weighted average of the risk of each security in the portfolio, and the covariance between each pair of securities in the portfolio
   4. Covariance terms increase rapidly as new securities are added to the portfolio

V. BENEFITS OF DIVERSIFICATION

A. Portfolio diversification
   1. Diversification can increase the risk/return tradeoff if the average correlation coefficient between individual securities in the portfolio is less than 1.0
   2. The benefits of diversification increase as the correlation coefficient gets smaller

B. Diversification across securities
   1. As the number of securities in a portfolio increases the portfolio risk decreases and approaches the risk of the total market
   2. Market risk is inherent from business cycles, inflation, interest rates, and economic factors
   3. Firm-specific risk is tied to the company’s labor contracts, new product development and other company related factors

C. Forms of Diversification
   1. Mathematical diversification
      a. Increasing the number of stocks reduces the portfolio risk from any individual stock
2. Diversification across time
   a. Annualized standard deviations decline as the investment horizon increases
   b. Uncertainty also increases and total return is not improved
3. Dollar cost averaging
   a. Strategy which invests a set dollar amount at regular intervals
   b. Depends upon diversification across time

D. Naive Diversification
   1. Naive diversification occurs when investors select stocks at random, and purchase and equal dollar amount of each security
   2. When N becomes large enough, naive diversification averages out the firm-specific (unsystematic) risk of the stocks in the portfolio, so that only the market (or systematic) risk remains

E. Efficient Diversification
   1. Efficient diversification finds the portfolio with the lowest risk for a given return, or the largest return for a given risk
   2. This eliminates all diversifiable risk
   3. Modern portfolio theory includes the concept of diversification and measures security risk using the capital asset pricing model (CAPM)

F. Efficient frontier
   1. A line graphing the most efficient possible combinations of stocks for maximizing portfolio returns while minimizing portfolio risk - the best risk/return tradeoff

G. Implications of Efficient Diversification
   1. Grouping many securities together in a portfolio reduces the risk of the portfolio faster than the return is reduced
   2. Holding a portfolio over time periods of five years or more reduces risk more than it reduces returns from the portfolio

VI. MEASURING RISK AND RETURN

A. One way to estimate the price expected at the end of a future holding period is to identify the price which will exist under alternative assumptions about the future

B. Ex-ante returns - predicted returns

C. Ex-post returns - historical returns
D. Standard Deviation as a measure of risk
   1. Statistical measure of dispersion of distribution about a mean
   2. 67% fall within one standard deviation
   3. 95% lies within two standard deviations

E. Since risk is the difference between the expected return on a security, and each of the possible future returns that may occur, it can be measured by the variance of expected returns.

F. Variance is an accurate measure of risk when the possible future returns are normally distributed around the expected future return

G. The range of returns, and the number of negative outcomes are non-parametric risk measures which are not influenced by the distribution of future returns

H. A more straightforward way to measure risk and expected future returns is to compute the mean and the variance from a sample of ex-post returns, and make the assumption that the future will look like the past

I. The coefficient of variation (CV) is usually computed from the ex-post mean and variance of an historical sample of returns

J. The coefficient of variation is a useful estimate of the risk to reward ratio which can be expected to accrue to the owners of a given security

K. Stocks can be grouped on the basis of either the expected return or the average risk

L. Within each group, the stock which has the lowest CV is the stock which provides the highest reward per unit of risk in the group

M. Mean Variance dominance is a property of the stock with the lowest CV in a group of stocks with identical risk or return

VII. PORTFOLIO RISK AND RETURN

A. In general, the purchase of a single stock is a speculation, rather than an investment
   1. the owner of single security hopes to profit from an increase in the price of the security during the near term
   2. profits and losses derived from near term changes in the price of a single asset are speculative in nature, and do not constitute investment returns

B. Investing involves buying and holding a portfolio of securities, expecting to profit in the long term from the secular price trend of the market

C. Portfolio diversification can reduce the risk an investor must bear without reducing the return an investor can expect to earn
LECTURE 18: CAPITAL ASSET PRICING THEORY

I. STUDENT LEARNING OBJECTIVES
   A. Capital Asset Pricing Model (CAPM)
   B. Capital market line (CML)
   C. Beta compared to Standard Deviation
   D. Applying CAPM to security analysis
   E. Estimating Beta
   F. Beta - good news and bad news

II. CAPITAL ASSET PRICING MODEL (CAPM)
   A. Equation that quantifies security risk and defines a risk/return relationship
   B. Based on the idea that investors accept a higher risk only for a higher return
   C. Other assumptions are not realistic, but necessary to develop the model
   D. Assumptions of the CAPM
      1. Investors have equal information and perceptions, leading to equal expectations
      2. Frictionless capital markets
         a. No transaction costs or taxes
         b. Securities infinitely divisible
      3. Investors are rational and seek to maximize their expected utility functions
      4. All investment is for the same time period
      5. All investors can borrow or lend at the risk-free rate
   E. Efficient Frontier and the Optimal Risky Portfolio
      1. The efficient frontier is a series of portfolios representing the highest return for a given level of risk or the lowest risk for a given expected return
      2. Any individual security will lie inside the efficient frontier, but may be a part of portfolios on the efficient frontier
      3. Choosing the optimal efficient frontier depends on individual preferences for risk and return
      4. Measuring risk aversion and utility curves still won’t provide an objective portfolio choice
III. DEVELOPING THE CAPITAL MARKET LINE (CML)

A. Expected Portfolio Return:  \( E(R_p) = (X) E(R_p) + (1 - X) RF \)

B. Portfolio Risk: \( SDP = (X) SD_p \)
   1. Combinations of risk-free assets and risky portfolios can be used to create portfolios along a line connecting the apex of the efficient frontier and the risk-free rate
   2. Describes the percentage holdings in the risk free asset and the risky diversified market portfolio, surpassing the efficient frontier except at the point of intersection
   3. Utility curves may cross the CML, indicating appropriate portfolio selections
   4. Borrowing-lending line is the CML, divided where it intersects the efficient frontier (point M) with the lending line on the left and borrowing on the right
   5. Portfolio separation theorem allows investors to separate the decision of selecting the risky portfolio from the investor’s risk preference

C. Market Portfolio
   1. The Market Portfolio (point M) must be the only risky portfolio chosen by all risk-averse investors. Because it is demanded by all investors, it must contain all the securities and other traded assets
   2. Portfolio M’s risk = Market risk
   3. Security risk = total risk
   4. Security risk = Market risk + firm-specific risk
   5. Portfolio M’s risk = (Security 1’s market risk + Security 2’s market risk + … + Security N’s market risk)

D. Relative Risk
   1. Relative risk contribution of security i
      a. Total risk contribution of security i divided by Total risk of market portfolio, M
   2. Known as beta, \( \beta \), it measures security risk, or volatility relative to the market portfolio
      a. Beta greater than 1.0 is riskier than the market
      b. Beta less than 1.0 is less risky than the market
   3. The value of beta implies something about returns relative to the market portfolio
   4. The choice of a proxy affects beta.

E. Types of CAPM Risk
   1. Systematic or non diversifiable risk
      a. Beta is the measure of systematic risk
2. Non Systematic or diversifiable risk
   a. Risk due to firm specific attributes
   b. Irrelevant in a well diversified portfolio
3. Decisions made by total risk (standard deviations) instead of beta ignore the systematic risk and diversifiable risk components of total risk

F. Deriving the CAPM
1. All risk averse investors will invest in one risky portfolio, M, which must be the market portfolio of all traded securities
2. M must have the same slope as the CML
3. \( ER_i = RF + \text{Risk premium} \)
4. \( (ER_i - RF) = \text{Risk premium} \)

G. Risk/return relationships
1. Security systematic risk, beta, can be defined as a ratio to the market return
2. \( E(R_i) = R_F + \beta_i (E(R_M) - R_F) \)
3. Security market line (SML) shows the risk/return relationship for securities and a graphical representation of the CAPM
4. Equation of a line is \( Y = a + bX \)
   a. \( a \) is the y-intercept and \( b \) is the slope
5. The y-intercept is the risk-free rate
6. The slope is \( (E(R_M) - R_F) \)
7. The equation of the SML is
   a. \( E(R_i) = R_F + (E(R_M) - R_F) \beta_i \)
   b. equal to equation for CAPM and similar to CML

H. Differences between CML and SML
1. Capital market line measures risk by standard deviation, or total risk
2. SML measures risk by beta to find the security’s risk contribution to portfolio M
3. CML graphs only defines efficient portfolios
4. SML graphs efficient and non efficient portfolios
5. CML eliminates diversifiable risk for portfolios
6. SML includes all portfolios that lie on or below the CML, but only as a part of M, and the relevant risk is the security’s contribution to M’s risk
7. Firm specific risk is irrelevant to each, but for different reasons
I. CAPM and Security Analysis
   1. With the equation: \( R_i = R_F + \beta_i (E(R_M) - R_F) \) we can estimate the required return for a security, on an SML graph.
   2. Calculate the predicted return for the security based on today’s price, a predicted price a year from today, and expected dividends in the coming year.
   3. Predict a holding period return and compare to the SML expected return.
   4. If a security seems likely to have a higher return than its risk level justifies, then it is undervalued (good investment).
   5. A lower expected return than its risk would justify suggests a security is overvalued (not a good investment).

J. Estimating Beta
   1. A beta estimate measures the changes of a security’s return relative to the market return.
   2. A security characteristic line graphs the relationship between the return on the market portfolio and a security return.
   3. The market model uses linear regression to estimate the relationship between the market return and the security return:
      \[ R_{i,t} = a_i + b_i R_{M,t} + e_{i,t} \]
   4. Beta estimates of are available from financial advisory services: i.e., Value Line, Merrill Lynch, etc.
   5. Using the market model one can calculate systematic risk and diversifiable risk:
      \[ SD_{i2} = \beta_{i2} SD_{M2} + SD_{e2} \]

IV. BETA: THE BAD NEWS
   A. Two issues with beta
      1. How important is the market proxy?
      2. How stable is beta? (inter-temporal stability)
   B. Research has shown little correlation between a security returns and market portfolio returns.
   C. Historical betas can be better predictors of future betas for large portfolios than it is for individual securities.
   D. The more securities in the portfolio, the better predictor the portfolio beta is.
LECTURE 19: EXTENSIONS OF CAPITAL ASSET PRICING THEORY

I. STUDENT LEARNING OBJECTIVES

A. Zero-beta portfolio model
B. Results of empirical testing of CAPM
C. Roll’s critique of CAPM
D. Arbitrage pricing theory

II. REVIEW OF CAPITAL ASSET PRICING MODEL

A. Securities are priced in relation to risk (beta) because all rational investors hold well-diversified portfolios
B. A security’s total risk (standard deviation) is composed of two types of risk
   1. beta risk
   2. diversifiable risk
C. Beta is estimated by a market regression model
D. Beta estimates can accurately predict future portfolio betas but not individual securities’ betas
E. Assumptions of CAPM are very restrictive

III. MODIFICATIONS OF THE CAPM

A. CAPM assumption: all investors can borrow or lend at the risk-free rate - unrealistic
B. Zero-beta portfolio: create a portfolio that is uncorrelated to the market (beta 0)
C. The return of the zero-beta portfolio may differ from the risk-free rate
D. Implications of Black’s Zero-beta model
   1. Any combination of portfolios on the efficient frontier will be on the frontier
   2. Any efficient portfolio will have associated with it a zero-beta portfolio
      a. Its return is found by the intersection of tangent line with the y-axis
      b. Its standard deviation is found by drawing a horizontal line from the intersection to the efficient frontier
   3. The expected return of any security can be expressed as a linear relationship of any two efficient portfolios

\[ E(R_i) = E(R_i)[Z(M)] + \beta_i \{E(RM) - E(R)[Z(M)]\} \]

4. If CAPM defines risk and return relationship, then zero-beta portfolio return should equal \( R_f \).
5. To test this - identify a market portfolio and solve for the return of a zero-beta portfolio
IV. EMPIRICAL TESTING OF CAPM

A. Implications must be jointly tested - any contradiction could come from either
   1. Risk/return relationship is consistent with the data
   2. The market is efficient

B. Typical testing starts with the market model in a regression of excess returns for a security on the excess returns for the market portfolio over a 60-month period

C. This first pass regression is used to estimate beta for a security and empirically testing CAPM

D. Excess return is over and above the required return estimated by CAPM or actual return minus the CAPM return

E. Time series regression uses data for one stock over time

F. The second pass regression uses the estimated betas as independent variables in cross-sectional regression

G. Cross-sectional regression uses data for many stocks at one time

H. Results of testing by Black, Jensen, and Scholes found that CAPM understated low betas and overstated high betas from 1931 to 1965

I. The zero-beta model fit the data better than CAPM, but was not consistent and the average zero-beta return is much greater than the risk-free rate

J. A major difficulty is the use of ex-post data to evaluate ex-ante returns

V. CRITICISM OF CAPM BY RICHARD ROLL

A. Limits on tests: only testable implication from CAPM is whether the market portfolio lies on the efficient frontier

B. Linear Risk/Return relationship require linear beta relationship, so second pass adds nothing

C. Market Portfolio Composition cannot be observed, so is not testable

D. Range of SML’s - infinite number of possible SML’s, each of which produces a unique estimate of beta

E. Market efficiency effects - substituting a proxy, such as the S&P 500 creates two problems
   1. Proxy does not represent the true market portfolio
   2. Even if the proxy is not efficient, the market portfolio might be

F. Conflicts between proxies - different substitutes may be highly correlated even though some may be efficient and others are not: Can lead to different conclusions regarding \( \beta \) risk/return relationships

G. So, CAPM is not testable - but it still has value and must be used carefully

H. Stephen Ross devised an alternative way to look at asset pricing - APT
VI. ARBITRAGE PRICING THEORY - APT

A. Arbitrage principle is a process of buying a lower priced asset and selling a higher priced asset, both of similar risk, and capturing the difference in arbitrage profits

B. The general arbitrage principles states that two identical securities will sell at identical prices

C. Price differences will immediately disappear as arbitrage takes place

D. Implications for investors

E. Risk is important in evaluating investments

F. Risk should be accounted for by models that help quantify that risk

G. Qualitative factors can help overcome shortcomings of CAPM for measuring risk
   1. Other strategies can be more successful than strictly investing in beta based strategies
   2. Some choose to ignore beta - “Beta is dead”
   3. Beta isn’t perfect, but risk must be measured in making risk/return decisions
   4. The assumptions of the CAPM were stringent, and not realistic and will be relaxed in the next Lecture in developing a general risk/return relationship
LECTURE 21: EVALUATING INVESTMENT PERFORMANCE

I. STUDENT LEARNING OBJECTIVES
   A. Three measures of investment performance based on modern portfolio theory
   B. Past performance as a predictor of future performance
   C. Applying modern portfolio theory to investment decisions
   D. Applying the Treynor-Black model

II. THREE PERFORMANCE MEASURES
   A. Comparing portfolio performance requires risk adjustment
   B. Treynor and Sharpe both focus on a risk premium as compensation for risk
   C. Treynor measure is reward per beta risk
   D. Sharpe measures total risk with standard deviation
   E. Jensen’s Alpha measures the actual mean return for a portfolio less the CAPM return

III. PAST PERFORMANCE AS A PREDICTOR OF FUTURE PERFORMANCE
   A. The performance measures use historical returns, but will they hold in the future?
   B. Results can be based on luck, especially short-term returns
   C. Pension fund managers with outstanding records tend to repeat
   D. Evaluations should be made over a long term

IV. APPLYING MPT TO INVESTOR DECISIONS
   A. Different groups of investors apply MPT differently depending on how strongly they believe in market efficiency
   B. Group 1 MPT investors believe the market is strong-form efficient and will invest in any naïve diversified portfolio
   C. Passive or naïve strategy invests in a well-diversified portfolio because one cannot “beat the market”
   D. Group 2 MPT investors believe in Semi-strong market efficiency and invest in growth stocks and a well-diversified portfolio to gain both benefits
   E. Group 2 investors will analyze securities to determine which stock to include in a well-diversified portfolio
   F. Group 2 investors will also analyze optimal allocation of the portfolio
G. Third group is somewhere between group 1 and group 2
H. They believe the market offers undervalued and overvalued stocks, but that finding them is nearly impossible, so they may act as group 1 investors
I. Other investors scorn MPT
J. Technicians may fall in this group

V. TREYNOR-BLACK PORTFOLIO COMBINATION MODEL

A. Mathematical Model to determine optimal combinations between undervalued stocks and the well-diversified naïve portfolio
B. Shows the tradeoff between buying growth stocks and the naïve portfolio
C. Finds the optimal allocation of the stocks
D. Appeals to group 2 MPT investors
E. Determine a well-diversified portfolio on the efficient frontier - a market portfolio
F. Identify a group of undervalued stocks using security analysis
G. Optimize the market portfolio using the undervalued portfolio
H. Select the proportion of allocations using the Sharpe measure
I. Implications for investors
   1. Diversify by investing in several securities or in mutual funds
   2. Measure performance using reward per risk to determine fund performance
   3. Measure performance over a long period of time, perhaps five years or more
   4. Understand the tradeoffs between picking high growth stocks over a well-diversified portfolio
LECTURE 15: OPTION FUNDAMENTALS

I. STUDENT LEARNING OBJECTIVES
   A. Characteristics of option contracts
   B. Option value at expiration
   C. Some common option trading strategies
   D. Option valuation
   E. Other securities that resemble options

II. CHARACTERISTICS OF OPTION CONTRACTS
   A. Option contract gives the holder the right to:
      1. Buy or sell a stated number of shares (100)
      2. At a specified price (exercise or strike price)
      3. Until a specified point in time (expiration date)
   B. An option to buy stock is a call option
   C. An option to sell stock is a put option
   D. Options are called derivatives because their value is derived from the underlying stock

III. CALL OPTIONS
   A. When a stock price exceeds the exercise price of a call option, the option is said to be “in-the-money”
   B. If the stock price is less than the call option’s exercise price, it is said to be “out-of-the-money”
   C. When the stock price equals the call option’s exercise price it is “at-the-money”
   D. Call options are bought by investors who expect the stock price to rise [soon].
   E. The holder of the option has a “long position”
   F. The person who sold (wrote) the option has a “short position”
   G. For every option traded there is both a long and a short position

IV. WRITING AN OPTION
   A. The person who sells an option (writes an option) receives a premium
   B. The call premium is the call price minus the current stock price plus the exercise price
   C. The put premium is the put price minus the exercise price plus the stock price
D. Option writers hope it expires out-of-the-money
E. Writing options offers unlimited loss to the writer for a limited gain
F. Only experienced traders who can risk substantial sums should write options

V. OPTION VALUE
A. Options are described with two values
B. Intrinsic value is the difference between the stock price and the exercise price, or zero if the option is not “in-the-money”
C. Time value is the difference in intrinsic value and the price of the option, even though this value depends on more than just the time until expiration

VI. OPTION TRADING
A. Options can be traded like stocks and bonds, using market orders or limit orders
B. Organized trading on exchanges has advantages over OTC option trading
   1. Standardized contracts
   2. Increased liquidity
   3. More comprehensive disclosure and surveillance
   4. Guaranteed clearing of contracts
   5. Lower transaction costs

VII. OPTIONS ON OTHER SECURITIES
A. Index options are calls or puts based on a stock market index, settled by cash rather than delivery of underlying securities
B. Foreign currency options allow the holder to buy or sell a quantity of foreign currency for a specified amount of U. S. Dollars
C. Long-term options, called LEAPS® have expiration dates up to two years from the date of issue

VIII. OPTION VALUES AT EXPIRATION: Symbols defined
A. $C_T$ = price of call option at a point in time
B. $P_T$ = price of put option at a point in time
C. $S$ = price of underlying stock
D. $E$ = exercise price
E. $T$ = time left until expiration
F. $T = 0$ at expiration
IX. CALL OPTION VALUE AT EXPIRATION
   A. Value at expiration depends on price of underlying stock
   B. If stock is worth less than exercise price, call option is worthless
   C. Call must be “in-the-money” to have value at expiration, then the value is the stock price less the exercise price
   D. Value at expiration depends on price of underlying stock
   E. If stock is worth more than exercise price, put option is worthless
   F. Put must be “in-the-money” to have value at expiration, then the value is the exercise price less the stock price

X. PROFIT AND LOSS FROM AN OPTION
   A. The profit and loss from an option writer and buyer are opposites
   B. The expense of buying an option is income to the writer/seller
   C. The profit/loss of the buyer is opposite of the profit/loss of the seller and the net sum of the buyer and seller profit/loss is zero
   D. In a zero sum game, in order for one to make money, another must lose

XI. OPTION TRADING RISKS AND OPPORTUNITIES
   A. Options trading can be to hedge, or reduce risk of stock positions
   B. Options trading exposes investors to unique risks because of the importance of timing and because it is a zero sum game
   C. Options trading provides leverage opportunities, similar to buying on margin
   D. Leverage is a double-edged sword, and can result in total loss of the cost of an option

XII. STRATEGIES OF ONE OPTION CONTRACT
   A. Select an underlying stock, then select a put or call depending on risk/return tradeoff
   B. For the buyer, an option further out-of-the-money or with a shorter time period has a greater potential return and greater risk
   C. The option writer takes more risk on an option with a strike price close to the stock’s price and/or with a longer expiration
D. Combining Option and Stock Positions
   1. Options are used to reduce the risk of the stock position by hedging
   2. Writing a covered call is writing a call on a stock that is already owned to increase the income from the stock while reducing the downside risk from the stock
   3. In a protective put one buys put options on stock already owned to reduce some of the downside risk
   4. A covered short sale involves buying a call option on stock the investor has shorted in order to reduce some of the risk of the short position

E. Determinants of Option Values
   1. Price of the underlying stock
   2. Exercise price
   3. Time until expiration
   4. Volatility of the underlying stock
   5. Level of interest rates
   6. Dividends

XIII. BLACK-SCHOLES MODEL FOR PRICING OPTIONS
A. Developed for European options which can be exercised only on expiration date
B. Assumes the risk-free rate and the underlying stock’s price volatility remain constant over the life of the option and the stock pays no dividends
C. If you know what the stock value will be when the option expires, then the call price equals the current stock price minus the present value of the exercise price
D. If there is no chance of the option expiring in-the-money the value of the option approaches zero
E. Black-Scholes in English:
   For all probabilities in between, the value of a call is equal to the expected stock price at expiration minus the present value of the exercise price, all weighted by the probability of the option expiring in-the-money.
F. Arbitrage Strategy Using the Black-Scholes model
   1. The model generates an estimate of the fundamental value of a call option
   2. If the market price of a call is higher than the estimated fundamental value of the call
   3. And if the model is correct, then buying the stock while writing the call will result in a profit no matter which way the stock price changes
G. Cautions for Using Black-Scholes
   1. The model does not consider dividend payments
   2. The model assumes the risk-free rate and the standard deviation of the stock return are both constant over time
   3. The model assumes that stock prices are continuous and do not have extreme jumps
   4. The model assumes that hedging is continuously managed

XIV. OTHER SECURITIES THAT RESEMBLE OPTIONS

A. Convertible securities (bond or preferred stock) give the owner the right to convert the security for a specified number of shares of common stock
   1. The prescribed number of shares obtained is referred to as a conversion ratio
   2. Conversion value is the current stock price multiplied by the conversion ratio
   3. The value of a convertible security may exceed the conversion value but should not fall below the conversion value
   4. The value of a convertible bond without the conversion feature is its “straight bond value” which will form the lower boundary for the value of the bond
   5. Convertibles offer attractive combinations of bonds and stocks
   6. Risks of convertibles
      a. Convertible bonds tend to be lower rated
      b. Convertible bonds have lower coupon rates than straight bonds
      c. Most convertibles are callable, a feature which can effectively force conversion

B. Warrants
   1. A Warrant is a long-term call option issued by the company giving the right to buy a number of shares at a set price for a fixed period of time
   2. Warrants are often attached to other securities
   3. Most warrants can be detached and traded
   4. Valuing a warrant is similar to a call option
Lecture 19: Futures Contracts

I. Student Learning Objectives
   A. What are futures contracts?
   B. Futures contracts valuation
   C. Who uses futures?
   D. Financial futures
   E. Options on futures

II. Futures Contract
   A. Forward contract calls for future delivery of an asset at a price agreed on today
   B. Futures contract is a highly standardized version of a forward contract that can be traded in organized exchanges
   C. A person agreeing to accept delivery of the asset has the long position
   D. A person agreeing to deliver the asset has the short position

III. History of Modern Futures Markets
   A. Forward and futures contracts go back to ancient Roman and Greek civilizations
   B. Modern futures exchanges began in 1848 with the Chicago Board of Trade (CBOT)
   C. Seasonal nature of grain production created wide fluctuations in price each year
   D. CBOT began to offer contracts to buy grain in advance of delivery
   E. Development of financial futures
      1. 1972 IMM/CME futures contracts on foreign currencies
      2. 1975 CBOT futures contracts on GNMA mortgage interest bearing securities
      3. 1976 IMM 90-day T-bills futures contracts
      4. 1977 CBOT futures on long-term T-bonds
      5. 1980’s stock index futures
   F. Today’s futures exchanges
      1. 14 exchanges in the United States, 11 major exchanges in other countries
      2. Some exchanges specialize in contracts, commodities
      3. The exchange that introduces a contract usually monopolizes trading of that contract
IV. TYPES OF CONTRACTS
   A. Physical commodities
      1. Agricultural products
      2. Nonagricultural products
   B. Financial futures
      1. Currency futures
      2. Stock index futures
      3. Interest rate futures
   C. Requirements for a viable futures market
      1. Ability to be standardized
      2. Active demand
      3. Ability to store asset for a period of time
      4. Relatively high value in proportion to bulk
      5. Relatively high value in proportion to storage and other carrying costs

V. MECHANICS OF FUTURES TRADING
   A. Automation has increased in recent years
   B. CBT and CME still use open outcry system
   C. Trading on exchange floor involves traders standing in trading pits for each type of contract
      bidding against each other
   D. All traders may trade any contract, but usually choose to specialize

VI. WHO ARE TRADERS
   A. Exchange members and their employees
      1. Memberships are limited and can be traded
   B. Three groups of traders
      1. Commission brokers trading for others
      2. Local traders trading for themselves or their firm
      3. Dual traders performing both functions
C. Trading Strategies
   1. Scalpers quickly trade for small changes in price
   2. Day traders do not hold positions overnight
   3. Position traders hold positions longer

D. The trading process
   1. Place an order with a broker, who relays it to the floor broker
   2. After execution, the floor broker relays confirmation back through the chain
   3. Orders can be market orders, stop-loss orders, limit orders, good until cancelled orders, and day orders
   4. Some brokerage firms do not offer futures trading, and commissions vary widely

E. The role of the clearinghouse
   1. Each futures market operates a not-for-profit corporation owned by members of the exchange as an intermediary and guarantor to every trade
   2. Every trade has a short and a long position
   3. Both parties must meet their obligations
      a. Deliver and take delivery of the asset at the agreed price and time
   4. The clearinghouse guarantees that both parties fulfill their obligations

F. Margins
   1. Futures transactions require posting margin deposits and meeting margin maintenance requirements
   2. A settlement price is established at the end of each trading day to calculate traders’ margins
   3. Each account is marked to market each day, adjusting each trader’s margin account by the change in settlement price

G. Daily limits
   1. Since futures trading is done on margins, limits are often established for daily changes in price on a contract
   2. If the contract price moves up or down by the maximum amount it is said to be limit up or limit down and no trading can take place outside the daily price limits
   3. Daily limits may be increased in some circumstances

H. Delivery procedure
   1. Many traders have no intention of taking delivery of, or delivering the asset on which they trade futures
   2. If delivery is to occur, the contract procedures must be followed
   3. The short position initiates the delivery procedure
I. Futures price quotations
   1. Open interest refers to the number of contracts outstanding at a point in time
   2. Open interests peak a few weeks before the delivery date and then decline sharply
   3. Basis is the difference between the spot price and futures price for an asset
   4. Convergence occurs as the delivery date approaches and the difference between spot and futures price goes to zero
   5. The difference between prices of two different futures contracts is a spread
   6. An intracommodity spread is the difference between two futures contracts on the same commodity but with different delivery dates
   7. An intercommodity spread measures the difference in price between two futures contracts on different assets but with the same delivery date

VII. FUTURES PRICES AND EXPECTED SPOT PRICES - FIRST THEORY OF FUTURES PRICING
   A. One theory holds that the presence of speculators in the market indicates a general relationship between futures prices and expected future spot prices
   B. Futures prices may only approximate the expected future spot price because of transaction costs and because both hedgers and speculators trade in futures
   C. Risk bearing services of speculators
      1. Hedgers may be net short in the market, leaving speculators net long
      2. In order for speculators to take long positions, the futures price has to be below the expected spot price
      3. If the expected price holds, then the futures price will move to meet the spot price providing a return to speculators for assuming risk that hedgers wish to avoid

VIII. FUTURES PRICES AND THE COST OF CARRY - SECOND THEORY OF FUTURES PRICING
   A. Costs to store an asset until the delivery date are referred to as the cost of carry
   B. Another theory of futures pricing holds that the price of a futures contract should reflect the current spot price plus the cost of carry
   C. \( F(n) = S(1+c) \)
   D. Arbitrage opportunities keep this relationship in line
   E. Restrictions on short sales
      A limitation to arbitrage opportunities is the difficulty to short the spot market while going long in the futures market to collect the carry cost and then take delivery, which may place an upper boundary on the price of a futures contract
F. Which theory of futures pricing is correct?
   1. Both help understand the relationship between spot prices, expected future spot prices, and futures prices
   2. Which theory is most accurate for a futures contract price may depend on the asset
   3. If there are few restrictions on short sales and hedgers are neither net long nor net short then futures are more closely related to costs of carry

IX. USES OF FUTURES CONTRACTS

A. Speculating with futures - outright long or short position is very risky
   1. Intracommodity spreads - combining short position of one date with long position of another date, as one contract increases in value the other will fall, the net depends on the direction of the market and the dates
   2. Intercommodity spreads combine a purchase of one contract with the sale of a related asset of the same delivery date
   3. The spread between heating oil and unleaded gasoline prices varies with production and weather

B. Hedging with futures
   1. Futures help traders hedge cash positions
   2. \( \Delta C + \Delta F = 0 \)
   3. Short hedge takes a short position in futures to offset a long position in the cash market
      a. Farmer worries that prices will fall before the crop gets to market and takes a short position in the futures market
      b. Long hedge is taken to offset a short position in the cash market

X. FINANCIAL FUTURES

A. Treasury bill futures
   1. Delivery dates in March, June, September, and December
   2. Face value per contract is $1,000,000 of T-bills
   3. Delivery of T-bills with maturity of 90 days

B. Treasury bills are sold at discount with no stated interest rate

C. Contract values are based on IMM index

XI. EURODOLLAR FUTURES

A. Futures based on Eurodollar bank deposit
B. Face value per contract is $1,000,000
C. Contract value is based on LIBOR
D. Eurodollars contracts are not discount securities, but pay interest
E. Futures are cash settled instead of delivery

XII. TREASURY BOND AND NOTE FUTURES
A. Futures on T-bonds and T-notes only differ in the deliverable instruments
B. Contract is on $100,000 par value, except for two-year note contract is $200,000
C. Prices assume a coupon rate of 8% and priced in 32nds of a percent
D. Delivery dates in March, June, September, and December

XIII. CONVERSION FACTORS AND INVOICE AMOUNT
A. Adjustments are made for delivery of securities with other than 8% coupon rate
B. The adjusted amount is due for contract delivery
C. Some bonds and notes are cheaper to deliver based on the conversion factors

XIV. STOCK INDEX FUTURES
A. S&P 500 futures on CME deliver in December, March, June and September
B. Price is quoted as the index X $500
C. No daily limits on price fluctuations
D. During extreme volatility trading in stock futures is suspended
E. Program trading is computer generated large trades simultaneous with index futures

XV. SPECULATING AND HEDGING WITH FINANCIAL FUTURES
A. Intracommodity spread combines long and short positions of different financial securities of the same delivery date
   1. Long March T-bonds and short December T-bonds
B. Short hedge offsets long cash position of similar assets

XVI. OPTIONS ON FUTURES
A. Calls and puts are available on most actively traded futures contracts
B. Buying a call option instead of a futures contract limits the loss and sacrifices some of the potential profit
C. Using a call option to protect a short futures position