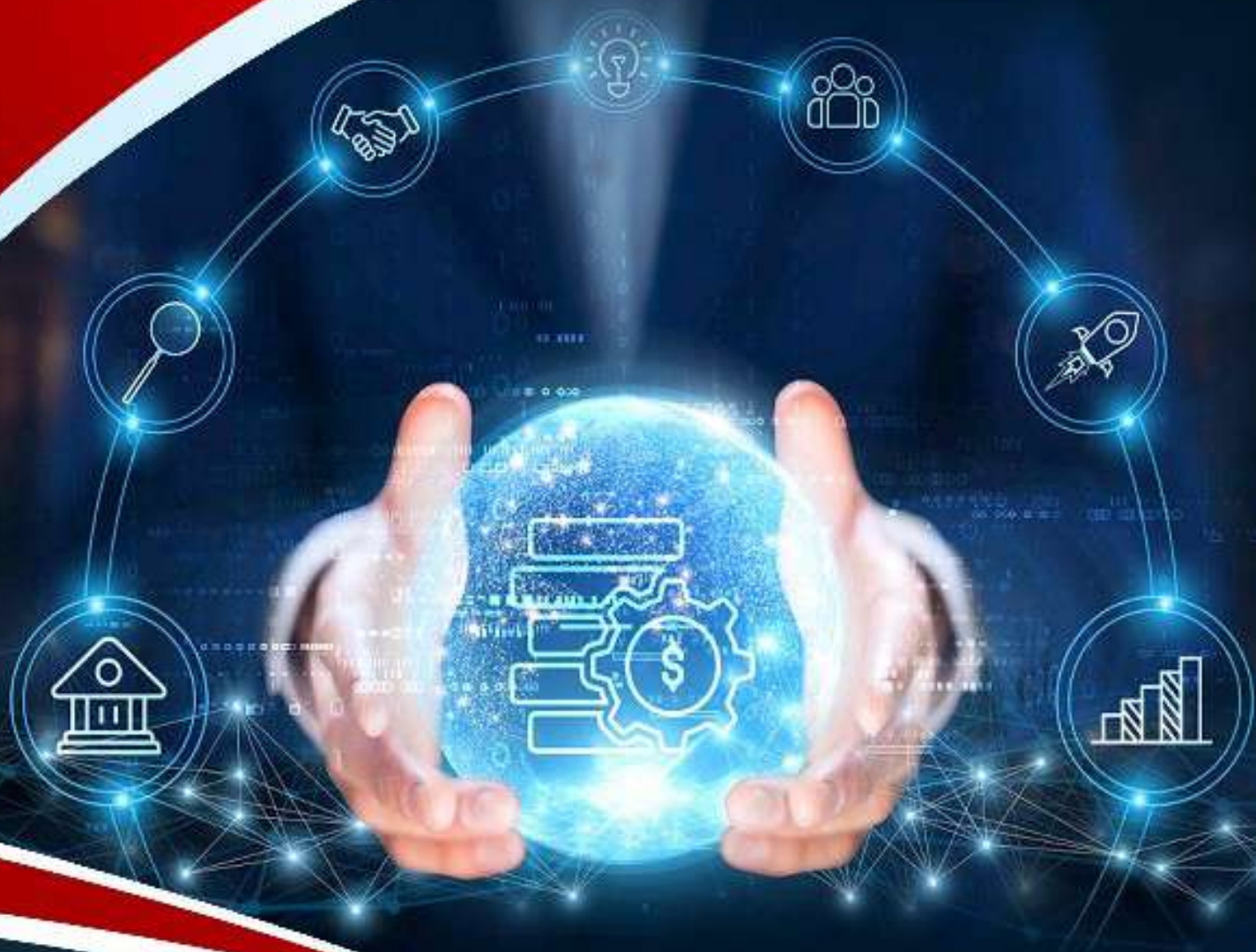


INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT



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Preface

Investment Analysis and Portfolio Management is a vital area of finance that bridges theory with practical decision-making. In an increasingly complex global economy, the ability to analyze investments, assess risk, and construct sound portfolios is indispensable for students, investors, and financial professionals alike. This book, *Investment Analysis and Portfolio Management*, has been carefully designed to serve as a comprehensive guide to the principles, tools, and techniques essential for making informed investment decisions. The primary objective of this book is to provide readers with a strong conceptual foundation and analytical framework for understanding financial markets, investment instruments, and portfolio management strategies. The text integrates both theoretical and applied aspects of investment analysis, covering topics such as the time value of money, risk and return, portfolio theory, asset pricing models, security analysis, and portfolio performance evaluation. Real-world examples, case studies, and illustrations are incorporated to help readers relate theoretical concepts to practical situations in the dynamic financial environment. The subject of investment management has evolved significantly over the past few decades with the advent of advanced technologies, global integration of markets, and the emergence of new financial instruments. This book takes into account these developments and aims to present a modern perspective on investment analysis that reflects current trends and practices in the financial world. Emphasis has been placed on developing analytical and decision-making skills, which are crucial for successful investment and portfolio management in today's volatile markets. The text is organized in a logical sequence, beginning with fundamental concepts of investment and risk analysis, progressing through portfolio construction and optimization, and concluding with advanced topics such as behavioral finance, derivatives, and contemporary portfolio management techniques. Each chapter is structured to facilitate clarity and understanding, including learning objectives, key terms, and review questions for self-assessment.

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CHAPTER I

BASICS OF INVESTMENT

1.1 Introduction

Investment refers to the commitment of funds to one or more assets that will be held over some future time period for the purpose of earning returns. It involves sacrificing current consumption in hopes of future gain.

Introduction

- **Investment planning** is the process of matching your financial goals and objectives with your **investment** resources.
- Planning is the most important part of the investing process, yet most investors spend the least amount of time on it.



Importance of Investments



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Importance of Investment



1.1.1 Why Investment

- Wealth Creation: Grow assets over time.
- Income Generation: Earn dividends, interest, or rental income.
- Beat Inflation: Maintain purchasing power as prices rise.
- Future Security: Emergency funds, retirement, children's education.
- Tax Benefits: Many investments have tax advantages (PPF, ELSS in India).



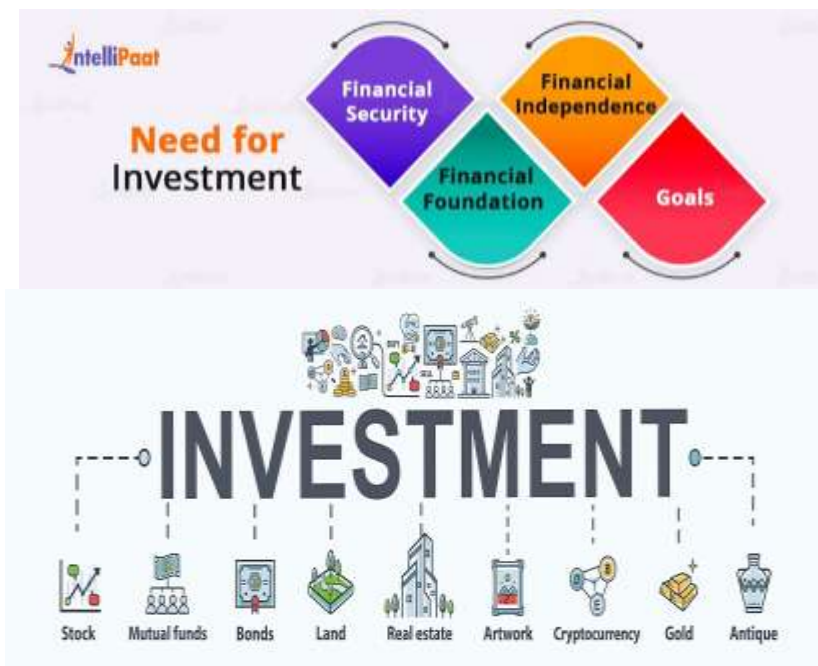
Illustrative Example:

Imagine you deposit Rs 10,000 in a savings account at 4% annual interest. In a year, you gain Rs 400 – a simple case of investment for income.



1.2 Need for Investment

- Changing Economy: To adapt to economic changes and face uncertainties.
- Rising Costs: Cover increasing costs of life and healthcare.
- Life Milestones: Save for marriage, home, children, retirement.
- Risk Mitigation: Insurance and diversification help manage life and market risks.



1.3 Investment process



1. Determining Investment Policy

This initial step involves setting clear investment objectives tailored to the investor's risk tolerance, time horizon, liquidity needs, and expected return. It includes choosing the types of assets (like stocks, bonds, real estate) and specifying constraints such as ethical considerations or regulatory requirements. The outcome is a well-defined investment policy statement that guides all future decisions.

2. Performing Security Analysis

In this phase, investors or analysts evaluate individual securities to determine their potential risks and returns. This involves both fundamental analysis (examining companies' financial statements, industry conditions, and economic factors) and technical analysis (studying price movements and market trends). The aim is to identify undervalued investment opportunities that align with the policy set in step one.

3. Constructing Investment Portfolio

After selecting securities, the focus is on building a diversified portfolio. This involves deciding how much to invest in each asset to maximize return for a given level of risk. Techniques such as asset allocation and diversification are employed to spread risk across different types of investments, ensuring no single asset can unduly impact the overall performance.

4. Revising the Portfolio

Markets, personal circumstances, and economic conditions change over time. This step involves periodically reviewing and rebalancing the portfolio to ensure it remains aligned with investment objectives and policy. Portfolio revision might mean selling some assets and buying others, or adjusting the proportions of different asset classes.

5. Evaluating the Portfolio Performance

The final step assesses how well the portfolio has performed relative to benchmarks or objectives. This includes calculating returns, measuring risk, and analyzing whether the investment strategy met the desired outcomes. If performance is unsatisfactory, the lessons learned inform future revisions in the portfolio and investment strategy.

1.4 Investment versus speculation

	Investment	Speculation
Time Horizon	Long-term	Short-term
Analysis	In-depth, fundamental	Limited, technical, or none
Risk Level	Moderate, controlled	High, sometimes excessive
Expectation	Steady returns, wealth growth	Quick profits, big wins or losses
Examples	Buying blue-chip stocks, PPF, bonds	Day trading, penny stocks, options

1.5 Investment alternatives

Investment alternatives refer to the various options available for deploying funds with the objective of earning returns. In investment analysis and portfolio management, understanding different investment alternatives is essential for building a diversified, risk-managed portfolio.

1.5.1 Types of Investment Alternatives

The main categories of investment alternatives are:

- a. Traditional Investments
- b. Equities (Stocks): Ownership in companies, potential for dividends and capital gain.
- c. Fixed Income (Bonds): Debt investments, provide regular interest income.
- d. Cash and Cash Equivalents: Bank deposits, Treasury bills—very liquid, low risk, low return.

1.5.2 Alternative Investments

- a. Real Estate: Investing in tangible property, either directly or via REITs. Offers potential for capital appreciation and rental income.
- b. Commodities: Raw materials like gold, oil, agricultural products. Can act as a hedge against inflation.
- c. Private Equity & Venture Capital: Providing capital to private companies or startups in exchange for ownership. These options target higher returns but carry greater risks and are less liquid.
- d. Hedge Funds: Pooled investment funds that employ complex strategies, including derivatives and leverage, aiming for absolute returns. Typically open only to accredited investors.
- e. Art and Collectibles: Investments in tangible items with potential increasing value over time, e.g., art, sports memorabilia.
- f. Crypto-currencies: Digital assets using blockchain technology, such as Bitcoin. High risk and volatility; regulatory uncertainty.
- g. Peer-to-Peer Lending: Lending money directly to other individuals or businesses via online platforms. Offers potentially higher returns but increased risk.

1.5.3. Key Features of Alternative Investments

- a. Low Correlation with Traditional Assets: They often move independently of stock and bond markets, helping diversify portfolios and reduce overall risk.

b. Potential for Higher Returns: Especially in private equity, venture capital, and certain hedge fund strategies. However, this comes with significantly higher risk.

c. Illiquidity: Many alternatives cannot be quickly converted into cash, often requiring long investment horizons.

d. Limited Regulation and Accessibility: Typically less regulated than traditional assets, with higher minimum investment requirements—mostly accessible to institutional or accredited investors.

e. Inflation Hedge: Real assets like real estate, commodities, and infrastructure can protect against rising prices.

1.5.4. Role in Portfolio Management

a. Diversification: Including alternative investments in a portfolio lowers dependence on traditional markets and can enhance risk-adjusted returns.

b. Customizing Risk Exposure: Alternatives provide options to tailor the risk and return profiles to suit specific investment objectives.

c. Downside Protection: Some alternatives perform well in market downturns or crises, offering stability.

1.6 Investment alternative comparison on parameter - safety

1.6.1 Investment Alternatives Comparison: Safety Parameter

Safety is a crucial factor when evaluating investment alternatives. Safe investments are those with minimal risk of loss of principal. Here’s a comparative overview of different investment alternatives ranked by safety:

Investment Type	Safety Level	Key Safety Features
Savings Accounts	Very High	Government-insured (FDIC/Deposit Insurance), zero risk of loss, instant liquidity
Fixed Deposits / CDs	Very High	Guaranteed returns, insured up to limits, principal protection, low default risk

Government Bonds	Very High	Sovereign guarantee, extremely low credit risk, highly liquid (US Treasurys, India PPF/NSC)
Money Market Funds	High	Invest in short-term debt, aim for capital preservation, very liquid
Public Provident Fund (PPF)	High	Government-backed, tax-free returns, lock-in period increases safety
AAA Corporate Bonds	Moderate	High credit rating, low default risk, sensitive to interest rates
Dividend Stocks	Moderate	Stable earnings, lower price volatility, not immune to market risk
Debt Mutual Funds	Moderate	Invest in bonds, relatively low risk, but market-dependent
Preferred Stocks	Moderate	Fixed dividends, higher claim than common stock, but subject to market risk
Gold, Commodities	Moderate-Low	Physical assets, safe-haven during crisis, but price fluctuation potential
Real Estate	Moderate-Low	Tangible asset, generally stable, less liquid, subject to market cycles
Private Equity/Hedge Funds	Low	High risk, illiquid, returns vary, not suitable for risk-averse investors
Cryptocurrency	Very Low	Highly volatile, unregulated, risk of complete loss

The safest investments are those backed by governments or insured banks (savings accounts, FDs, CDs, government bonds).

Safety decreases as you move toward market-linked or alternative options—stocks, real estate, and especially private equity or

cryptocurrencies.

Always balance safety with other parameters like returns, liquidity, and investor goals before choosing an investment alternative.

1.7 Investment alternative comparison on parameter liquidity

Liquidity refers to how quickly and easily an investment can be converted into cash without significant loss of value. Here's a comparative table of investment alternatives ranked by their liquidity:

Investment Type	Liquidity Level	Details & Examples
Cash/Savings Account	Very High	Immediate access, no restrictions
Money Market Instruments	Very High	Can be sold quickly (T-bills, commercial paper, money market funds)
Online Savings Account	Very High	Funds can be accessed instantly
Mutual Funds/ETF	High	Can be sold on any business day at market value
Publicly traded stock	High	Can be sold on exchanges during trading hours, price may vary
Government Bond (Short Term)	High	Easily tradeable, especially those maturing in one year or less
Certificate of Deposits	Moderate	Fixed terms; early withdrawal usually incurs penalties
Corporate Bonds	Moderate	Tradeable but not always as liquid as stocks or government bonds
Gold and Commodities (ETF)	Moderate	Physical gold less liquid; Gold ETFs easier to sell
Real Estate	Low	Can take weeks-months to sell property, market dependent
Private Equity/Hedge	Very Low	Highly illiquid, exit only after long lock-in periods

Funds		
Art, Collectables	Very Low	Limited market, difficult to sell quickly
Direct Ownership(Private companies)	Very Low	No public market, sale can take months/years

The most liquid investments are cash, savings accounts, and money market instruments. Stocks, ETFs, and mutual funds also provide high liquidity due to easy market access. Assets like real estate, private equity, art, and direct ownership in private companies are considered illiquid due to slow sale processes and limited buyers. Liquidity is crucial for meeting emergency needs and managing portfolio risk; illiquid assets might generate higher returns but require patience and long-term commitment.

1.8 Investment alternative comparison on parameter growth

Growth measures the potential for an investment to increase in value over time. Here's how common investment alternatives compare on growth potential:

Investment Type	Growth Potential	Details & Examples
Growth Stocks (Equities)	Very High	Tech and emerging market companies (e.g. Nvidia, Apple) often offer strong long-term growth, but can be volatile
Venture Capital / Private Equity	Very High	Invests in startups or companies with potential for exponential growth; high risk, high reward, require expertise
Cryptocurrency	Very High	Digital assets can offer dramatic appreciation due to volatility; regulatory risks

Real Estate (Direct Ownership, REITs)	High	Property tends to appreciate over time; subject to market cycles and requires active management
Hedge Funds	High	Employ diverse strategies aiming for high returns, often riskier and less regulated
Dividend Stock	Moderate	Mature companies with regular dividend payout, long-term compounding growth
Mutual Funds / ETFs	Moderate-High	Diversified equity funds offer steady growth; safer than direct stock picking
Commodities (Gold, etc.)	Moderate	Can grow, especially during inflation or crisis; growth is usually cyclical
Government Bonds	Low	Fixed returns, principal protection, little to no real capital growth
Savings Accounts / CDs	Very Low	Minimal growth due to low interest rates, mainly preserves capital

The highest growth potential exists in growth stocks, venture capital, private equity, and cryptocurrencies but with significantly higher risk and volatility. Real estate and hedged funds can deliver high but less explosive growth over the long term. Dividend stocks, mutual funds, and ETFs offer moderate growth with less risk than alternatives like venture capital or crypto. Government bonds, savings accounts, and CDs provide stability and low risk, but minimal growth. Investors should balance growth potential with risk tolerance and portfolio diversification for the best outcomes.

The investment triangle



1.9 Mutual funds

1.9.1. Overview on Safety, Liquidity, and Growth

Mutual funds are investment vehicles that pool money from many investors to invest in a diversified portfolio of securities such as stocks, bonds, or other assets. They offer a way to diversify investments and are managed by professional fund managers.

1.9.2. Safety

Mutual funds vary in safety depending on their investment focus. Debt mutual funds and liquid funds generally prioritize safety by investing in short-term, high-quality debt instruments. Equity mutual funds carry higher risk due to market volatility. Fund managers may hold cash to reduce liquidity risk, enhancing safety.

1.9.3 Liquidity

Mutual funds generally offer high liquidity as investors can redeem units at the Net Asset Value (NAV) on any business day. Some types, like liquid funds, provide quicker access with minimal risk of capital loss. However, liquidity risk varies by fund type; growth or small-cap funds tend to have higher liquidity risk due to investments in less liquid stocks.

1.9.4. Growth

Growth mutual funds target capital appreciation by investing in companies expected to grow earnings significantly. They carry higher risk and usually require a longer investment horizon. These funds tend to have higher returns potential compared to income or balanced funds but are less liquid due to holdings in smaller or less liquid s

1.10ETFs

1.10.1. Importance of ETFs in Investment Management

ETFs (Exchange-Traded Funds) have become essential components of modern investment portfolios. Their importance stems from a combination of practical features and strategic advantages:

1. Diversification

ETFs typically track entire indices or sectors, allowing investors to hold a

wide variety of securities with a single purchase. This reduces unsystematic (company-specific) risk without the need to buy multiple individual stocks or bonds.

2. Liquidity

ETFs trade throughout the day on stock exchanges, with prices fluctuating like individual stocks. High liquidity means investors can enter or exit positions quickly and efficiently, important for both individual and institutional investors.

3. Cost Efficiency

Most ETFs have lower management fees and expense ratios compared to actively managed mutual funds. Passive management and low turnover lead to fewer embedded costs.

4. Transparency

ETFs regularly disclose their holdings—typically daily.

Investors have clarity about what the fund owns at all times, supporting informed decisions.

5. Flexibility

Investors can buy, sell, or short ETFs as easily as stocks, and use advanced trading techniques like stop orders or margin trading. A range of ETFs allows targeting specific sectors, regions, themes, or investment strategies.

6. Tax Efficiency

ETFs often generate fewer taxable events, such as capital gains distributions, due to their creation/redemption structure.

7. Accessibility

Even small investors can access diversified portfolios (e.g., an S&P 500 ETF) without the need for large capital outlays.

1.11 Hedge funds

1.11.1. Key Features of Hedge Funds

a. Investment Approach: Hedge funds use a variety of sophisticated

strategies, including leverage, short-selling, derivatives, arbitrage, and concentrated bets.

b. Regulation: They are less regulated compared to mutual funds and ETFs, often operating with more flexibility.

c. Liquidity: Typically illiquid with lock-in periods, often requiring investors to commit capital for several years.

d. Minimum Investment: High minimum investment requirements, often upwards of ₹ 1 crore or equivalent.

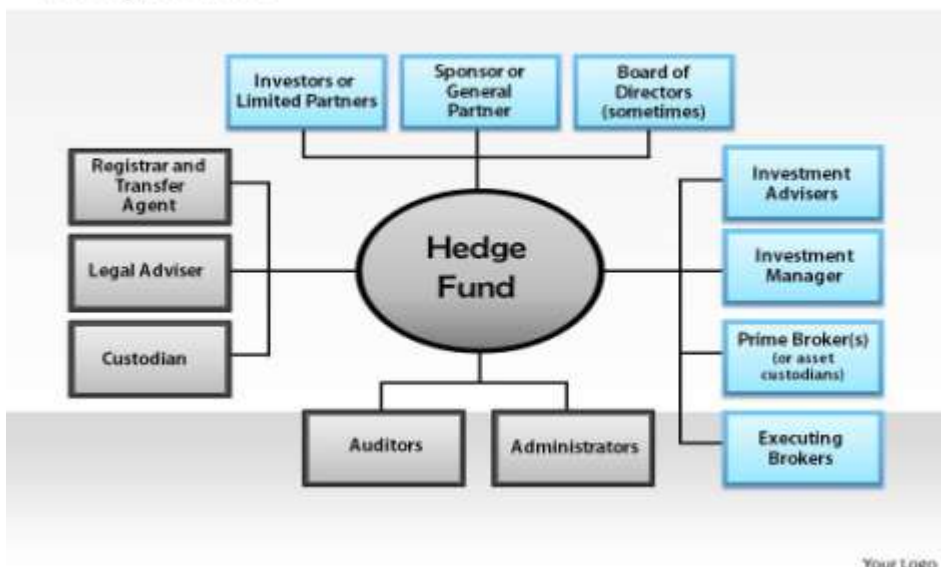
e. Fee Structure: Performance fees can be as high as 20% of profits plus a management fee.

f. Risk and Returns: Higher risk but potential for outsized returns, including targeting positive returns regardless of market conditions (absolute return strategies).

g. Transparency: Less transparency compared to mutual funds and ETFs.

h. Investor Access: Restricted to accredited investors and institutional clients due to complexity and risk.

Hedge Funds



1.12 Benefits and costs of fund investing



Fund investing through vehicles like mutual funds, ETFs, and hedge funds offers several benefits and costs for investors. Here's a detailed list breaking down the advantages and disadvantages:

Diversification

Funds invest in a wide range of securities, reducing unsystematic risk compared to single-stock investments.

Professional Management

Experienced fund managers handle research, selection, and portfolio maintenance on behalf of investors.

Liquidity

Mutual funds and ETFs typically allow easy buying and redemption, providing good liquidity for investors.

Accessibility

Low minimum investment amounts make fund investing accessible for retail investors.

Convenience

Investors gain exposure to complex markets (bonds, international equities, sectors) without deep research or trading.

Variety of Choices

Funds are available for different asset classes, risk profiles, and investment strategies, from conservative to aggressive.

Cost Efficiency (Especially ETFs)

ETFs typically have low expense ratios and trading costs compared to individual stock or bond investing.

Transparency

Mutual funds and ETFs disclose holdings and Net Asset Values regularly, keeping investors informed.

Tax Efficiency

ETFs are known for tax-efficient structures, minimizing capital gains distributions compared to mutual funds.

Systematic Investment Planning

SIPs (Systematic Investment Plans) allow disciplined, regular investments with rupee-cost averaging benefits.

Regulatory Oversight

Mutual funds are regulated, providing investor protection and operational transparency.

Flexibility

ETFs trade like stocks during market hours, allowing quick reactions to market changes.

Risk Management

Some funds include hedging strategies or focus on bonds to manage portfolio risk.

Costs / Disadvantages of Fund Investing

Management Fees and Expense Ratios

Funds charge fees which reduce overall returns; actively managed funds tend to have higher fees.

Sales Loads / Commissions

Some funds have entry or exit loads, adding transactional costs.

Potential for Over-diversification

Excessive diversification can dilute returns by spreading investments too thin.

Lack of Control

Investors cannot directly control asset selection or timing of trades in the

fund.

Risk of Market Volatility

Fund returns are subject to market risk; no guaranteed returns.

Tax Implications

Mutual funds may generate capital gains taxes on distributions, reducing after-tax returns.

Performance Variability

Actively managed funds may underperform their benchmarks due to poor management or market conditions.

Liquidity Constraints (Hedge Funds)

Some funds, especially hedge funds, have lock-in periods, limiting investor access to capital.

Tracking Errors (ETFs)

ETFs may not perfectly replicate the performance of their underlying index.

Complexity

Certain funds (hedge funds, sector funds) can be complex and difficult for average investors to fully understand.

Market Timing Risks

Frequent trading or market timing attempts by fund managers may hurt returns.

Dependence on Fund Manager Skill

Fund performance heavily depends on manager expertise, which may vary.

Redemption Constraints

Some funds impose restrictions or fees on early redemption.

1.13 Choosing a fund type

1. Define Your Investment Objective

Growth: Look for equity mutual funds, index ETFs, sector or thematic funds.

Income: Consider bond funds, dividend-paying ETFs, or income-focused

mutual funds.

Capital Preservation: Opt for liquid funds, debt mutual funds, or government bond ETFs.

2. Assess Your Risk Tolerance

Low Risk: Debt funds, liquid funds, government bond ETFs.

Moderate Risk: Large-cap equity funds, balanced or hybrid funds, diversified ETFs.

High Risk: Small-cap/mid-cap funds, sector/thematic funds, hedge funds, cryptocurrency ETFs.

3. Consider Liquidity Needs

Immediate Access: ETFs and open-end mutual funds offer easy redemption; hedge funds often have lock-in periods.

Long-Term Commitment: Hedge funds or closed-end funds may suit those with longer horizons and less need for withdrawals.

4. Analyze Costs and Fees

Expense Ratio: ETFs often have lower costs than actively managed mutual funds and hedge funds.

Performance Fees: Hedge funds typically charge higher fees due to specialized management and aggressive strategies.

Entry/Exit Loads: Some mutual funds charge loads, which affect returns.

5. Review Transparency and Regulation

High Transparency: Mutual funds and ETFs provide regular disclosures.

Low Transparency: Hedge funds can be less transparent; suitable for sophisticated investors.

Regulation: Mutual funds and ETFs are highly regulated; hedge funds operate with fewer restrictions.

6. Accessibility

Retail Investors: Mutual funds and ETFs are accessible with low minimum investments.

Accredited/Institutional Investors: Hedge funds have higher entry thresholds.

CHAPTER II

RISK AND RETURN OF PORTFOLIO



2.1 Concepts of risk and return

1. Definition of Risk

Risk in investment refers to the uncertainty or variability regarding the future returns. It represents the possibility that the actual returns may deviate from the expected returns, which can result in financial loss or lower profit. Different types of risks affect investments like market risk (systematic), credit risk, liquidity risk, and operational risk. Understanding risk is essential as it defines the level of exposure an investor faces.

2. Definition of Return

Return is the gain or loss generated from an investment over time, typically expressed as a percentage of the amount invested. Returns consist of income (dividends or interest) and capital appreciation (increase in asset price). Investments aim for positive returns, but actual realized returns may vary due to risk factors.

3. Risk-Return Tradeoff

A fundamental financial principle stating that higher risk investments typically have higher expected returns, compensating investors for taking on greater uncertainty. Conversely, lower-risk investments usually yield lower returns. This tradeoff guides investor decisions, balancing acceptable risk with required returns based on personal tolerance and goals.

4. Types of Risk

Systematic Risk: Market-wide risk impacting all securities (e.g., economic recessions, interest rate changes). Cannot be diversified away.

Unsystematic Risk: Company- or industry-specific risks (e.g., management failure, product recall). Can be mitigated through diversification.

5. Measuring Risk

Standard Deviation: Measures volatility; how much returns fluctuate around mean.

Beta: Measures sensitivity of a security or portfolio to overall market movements. $\text{Beta} > 1$ indicates higher volatility than market; < 1 indicates less.

6. Measuring Return

Historical Return: Past average returns measured over time.

Expected Return: Forecasted return calculated using models like CAPM, based on risk and market factors.

7. Importance of Diversification

Spread investments across asset classes, sectors, and geographies to reduce unsystematic risk. Diversification smooths portfolio returns and protects against significant losses from any single investment.

8. Portfolio Risk and Return

A portfolio's return is the weighted average of individual asset returns. Portfolio risk considers correlations between assets, with diversification

potentially reducing overall risk below the sum of individual risks.

9. Role in Investment Decisions

Assessing risk-return helps investors choose assets aligning with their risk appetite and financial goals, enabling optimal portfolio construction and long-term wealth maximization.

10. Practical Example

Stocks often provide higher returns with increased risk, bonds offer moderate returns with less risk, and cash equivalents provide stability with low returns, illustrating the risk-return spectrum across asset classes.

2.2 Risk and return measurement of the portfolio

1. Portfolio Return Measurement

Portfolio return is the weighted average of the returns of individual assets within the portfolio. It is calculated by multiplying the return of each security by its proportion in the portfolio and summing these values:

$$R_p = \sum (w_i \times R_i)$$

where w_i is the weight and R_i the return of asset i

2. Portfolio Risk Measurement

Portfolio risk reflects the uncertainty or volatility in portfolio returns. It depends on individual asset risks and how these assets correlate. Unlike individual risk, diversification causes the portfolio risk to be less than the weighted sum of individual risks.

3. Variance and Standard Deviation

Variance measures the dispersion of returns around the mean.

Standard deviation (square root of variance) measures total portfolio volatility and is widely used for risk quantification.

4. Covariance and Correlation

Covariance measures how two assets move together; positive means they move in the same direction.

Correlation standardizes covariance (-1 to +1), showing strength and direction of linear relationship. Low or negative correlations reduce portfolio risk effectively.

5. Formula for Portfolio Variance

$$\sigma_p^2 = \sum_i \sum_j w_i w_j \sigma_i \sigma_j \rho_{ij}$$

where σ_i is the standard deviation of asset I and ρ_{ij} is the correlation between assets i and j

6. Beta of Portfolio (Systematic Risk)

Beta measures portfolio sensitivity to market movements, assessing systematic risk. It is the weighted average of asset betas:

$$\beta_p = \sum (w_i \times \beta_i)$$

7. Risk-Adjusted Performance Metrics

Sharpe Ratio: Excess return per unit of total risk.

Treynor Ratio: Excess return per unit of systematic risk (beta).

Jensen's Alpha: Excess return above CAPM expectations, indicating skill.

8. Maximum Drawdown

Measures the maximum loss from a portfolio peak to a trough before a new peak, highlighting downside risk.

9. Importance of Benchmarking

Comparing portfolio returns and risk measures against relevant market indices helps assess relative performance and risk appropriateness.

10. Practical Implications

Understanding portfolio risk and return supports constructing efficient portfolios aligned with investor risk tolerance and return objectives.

2.3. Different Types of Investment Risks



1. Market Risk

Risk of losses due to overall market fluctuations caused by economic, political, or natural events. Includes equity risk (stock price changes), interest rate risk (bond prices affected by interest changes), and currency risk (exchange rate movements).

2. Liquidity Risk

Risk that an asset cannot be quickly sold or converted into cash without significant loss in value. Important for assets like real estate or private equity, less so for highly traded stocks or bonds.

3. Concentration Risk

Risk arising from excessive investment in a single asset, sector, or geography, leading to higher vulnerability if that segment underperforms.

4. Credit Risk

Risk that a bond issuer or borrower will default on payment of interest or principal. Higher in corporate and high-yield bonds; government bonds typically carry lower credit risk.

5. Reinvestment Risk

Risk of being unable to reinvest cash flows (interest, dividends, principal repayments) at the same rate of return as the original investment, leading to lower income.

6. Inflation Risk

Risk that inflation will erode the real value (purchasing power) of investment returns and principal, especially relevant for fixed income investments.

7. Horizon Risk

Risk that the investment holding period will be shortened due to unforeseen circumstances (e.g., job loss, emergency), potentially forcing asset sales at unfavorable prices.

8. Longevity Risk

Risk of outliving your investment assets or retirement savings, leading to potential financial shortfall in later life.

9. Foreign Investment Risk

Risks associated with investing internationally, including currency fluctuations, political instability, regulatory changes, and differences in market operations.

2.4 Diversification in Managing Different Types of Portfolio Risks



1. Risk Reduction Through Diversification

Diversification mitigates unsystematic risk (specific to companies or sectors) by spreading investments across various assets. Since these risks are not correlated, poor performance in some assets is offset by better returns in others, reducing overall portfolio volatility.

2. Managing Systematic Risk

While systematic risk (market-wide risk) cannot be eliminated, diversification cushions the portfolio's exposure by balancing asset classes and geographical regions that may react differently to economic events,

thereby smoothing return fluctuations.

3. Asset Class Diversification

Investing across asset classes—stocks, bonds, real estate, commodities, cash—ensures that a downturn in one class does not severely impact the entire portfolio. Each asset class reacts differently to market conditions.

4. Sector and Industry Diversification

Allocating investments across sectors (e.g., technology, healthcare, finance) counters industry-specific shocks, reducing risk concentrated within any one industry.

5. Geographic Diversification

Investing globally across countries and regions disperses risks related to local economic downturns, political instability, or regulatory changes.

6. Correlation Understanding

Diversification benefits increase when investments have low or negative correlations, meaning their values move independently or in opposite directions, thus stabilizing portfolio returns.

7. Time Diversification

Investing over different periods (multiple vintages for funds or staggered purchases) reduces the risk of market timing and smooths out returns.

8. Enhanced Risk-Adjusted Returns

By reducing risk without proportionally reducing expected returns, diversification improves the portfolio's Sharpe ratio and overall efficiency.

9. Managing Volatility and Drawdown

Diversified portfolios generally experience lower volatility and smaller draw downs, protecting investors from severe losses.

10. Limitations and Monitoring

Diversification cannot eliminate all risks (especially systematic risk), and over-diversification may dilute returns. Regular portfolio review and

rebalancing are critical to maintaining effective diversification.

2.5. Minimizing the risk and maximizing the return



1. 1.Diversification

Invest across different asset classes (equities, bonds, real estate, commodities) and sectors to spread unsystematic (asset-specific) risk. Diversification ensures that poor performance in one investment is offset by better performance in others, lowering overall portfolio volatility.

2. Asset Allocation

Carefully decide the proportion of funds in each asset class based on your risk tolerance, investment goals, and time horizon. Dynamic allocation (adjusting weights as conditions change) helps capture opportunities and control risk.

3. Risk Assessment and Profiling

Understand your risk tolerance, investment objectives, and financial situation. Tailor your portfolio accordingly—conservative investors should prioritize stable assets, while aggressive investors can allocate

more to equities for higher return potential.

4. Regular Monitoring and Rebalancing

Review your portfolio periodically. Rebalancing—selling high-performing assets and buying underperformers—automatically keeps risk in check and maintains your intended risk-return profile.

5. Hedging Strategies

Use hedging tools like options, futures, or stop-loss orders to protect against adverse market movements and limit potential losses.

6. Investing in Quality Securities

Prefer fundamentally strong companies with good earnings history, sound management, and sustainable business models. This reduces business and financial risk.

7. Utilizing Risk-Return Metrics

Evaluate investments using risk-adjusted measures like Sharpe ratio, Treynor ratio, and Jensen's alpha. Aim to select investments with the highest possible return for a given level of risk.

8. Avoiding Over-Concentration

Don't put all your money in one asset or sector. Over-concentration increases unsystematic risk; spreading investments is key to stability.

9. Following Market Trends and Economic Indicators

Stay informed about macroeconomic conditions, interest rates, and market cycles. This helps in making tactical decisions to minimize risk and capitalize on returns.

10. Professional Guidance and Research

Leverage expertise from financial advisors, portfolio managers, or conduct thorough research before making investment decisions.

2.6 Risk and reward of stocks and bonds

1. Nature of Stocks and Bonds

Stocks: Represent ownership shares in a company, providing equity participation and potential for capital gains and dividends.

Bonds: Represent debt; investors lend money to issuers who pay fixed interest and return principal at maturity.

2. Risk Profile

Stocks: Higher risk due to market volatility, company performance dependence, and residual claims in bankruptcy.

Bonds: Generally safer with fixed income, but subject to interest rate risk, credit/default risk, and inflation risk.

3. Return Characteristics

Stocks: Potentially high returns through price appreciation and variable dividends; returns are uncertain.

Bonds: Provide stable and predictable interest income but generally offer lower returns than stocks.

4. Income Certainty and Priority

Bonds pay fixed, scheduled interest and have priority over stocks in company liquidation.

Stock dividends are not guaranteed, and shareholders are last to be paid if a company faces bankruptcy.

5. Market Behavior and Sensitivity

Stocks react strongly to corporate earnings, economic cycles, and investor sentiment.

Bonds are sensitive to changes in interest rates, credit rating shifts, and inflation expectations.

6. Risk Management via Asset Allocation

Combining stocks and bonds in a portfolio balances risk and return; stocks drive growth, bonds provide stability.

Typically, younger investors allocate more to stocks; conservative or older investors favor bonds for income and preservation.

7. Historical Performance Trends

Over the long term, stocks generally outperform bonds, but with higher

volatility and risk of loss.

Bonds offer consistent income and capital preservation but with lower growth potential.

8. Tax Considerations

Stock gains often benefit from capital gains taxation (potentially lower rates).

Bond interest income is usually taxed as ordinary income, except for tax-exempt bonds.

9. Typical Uses in Portfolios

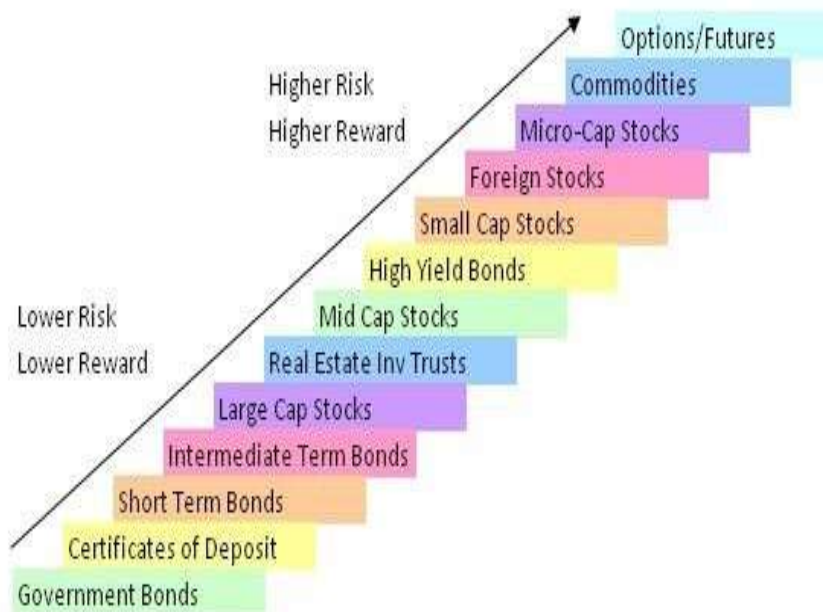
Stocks are suited for growth-oriented strategies.

Bonds are key for income generation, risk mitigation, and capital preservation.

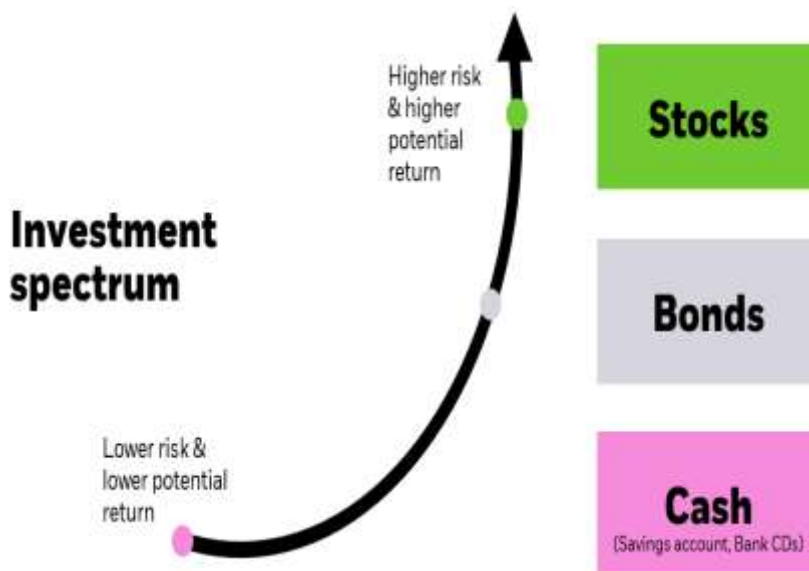
10. Examples of Risks Specific to Bonds and Stocks

Stocks: Market risk, business risk, liquidity risk.

Bonds: Interest rate risk, default risk, reinvestment risk.



2.7 How Do Stocks and Bonds Differ in Risk and Return Over Time?



1. Risk Levels:

Stocks are generally riskier than bonds. Their prices tend to fluctuate widely due to business performance, economic cycles, market sentiment, and geopolitical events.

Bonds are typically safer investments, providing fixed interest payments and priority in case of issuer bankruptcy, but they carry risks such as interest rate risk and credit/default risk.

2. Return Potential:

Stocks offer higher potential returns through capital appreciation and dividends, driven by company growth and profitability. Over the long run, stocks have historically provided higher average returns compared to bonds.

Bonds provide lower but more stable returns, mainly via regular interest payments, which protect capital but limit growth.

3. Volatility Over Time:

Stocks exhibit higher volatility with possible large gains or losses in short-term periods but tend to smooth out and show more positive returns over a

long investment horizon due to economic growth and company earnings expansion.

Bonds usually have lower volatility and more predictable returns, making them less sensitive to short-term market fluctuations.

4. Correlation and Economic Cycles:

Stocks and bonds often have an inverse or low correlation, with stocks performing well during economic expansions and bonds holding value or increasing during market downturns, offering diversification benefits. However, periods like 2022 saw both asset classes decline simultaneously due to rising interest rates.

5. Historical Performance:

For example, over several decades, U.S. stocks like the S&P 500 have averaged annualized returns between 8% to 10%, whereas broad bond indices have yielded around 3% to 5%.

Stocks experience positive annual returns roughly 75% of the time, while bonds nearly always provide positive returns over calendar years.

6. Income vs Growth:

Bonds primarily provide income stability through fixed coupon payments; this makes them attractive for conservative or income-focused investors.

Stocks focus on growth and capital appreciation, suitable for investors with a long time horizon willing to accept risk.

7. Impact of Time Horizon on Risk:

Stocks become less risky on an annualized basis as the investment period lengthens, benefiting from compounding and recovery from downturns.

Bonds are less affected by time horizon in terms of risk due to their fixed income nature.

8. Tax Implications:

Stock gains are generally taxed as capital gains, which can receive preferential treatment.

Bond interest is taxed as ordinary income, potentially leading to higher tax

bills.

9. Investment Strategy Considerations:

Younger investors often favor stocks for long-term growth potential.

Older investors or those close to financial goals often shift toward bonds to preserve capital and ensure income.

2.8 Stocks are considered riskier but potentially more rewarding than bonds for several key reasons:

1. Ownership vs Debt: When you buy stocks, you become a partial owner of the company, exposing your investment to the company's business risks and performance, which can fluctuate widely. Bonds, however, represent a loan to the issuer with contractual interest payments and principal return, making them less risky.

2. Return Variability: Stocks provide returns primarily through capital appreciation and sometimes dividends, both of which are uncertain and market-dependent. Bond returns mainly come from fixed interest payments and the return of principal at maturity, offering more predictable, stable returns.

3. Claim Priority: In case of bankruptcy, bondholders have priority over stockholders in claims on company assets, meaning stockholders risk losing their entire investment more readily.

4. Market Volatility: Stock prices are more volatile due to changing company prospects, economic conditions, investor sentiment, and market speculation. Bonds, especially government bonds, tend to have lower price volatility.

5. Inflation and Growth Potential: Stocks can increase in value as companies grow and have revenues that may keep pace with inflation, providing a hedge against inflation. Bonds, particularly fixed-rate bonds, may lose real value if inflation rises.

6. Historical Performance: Over long periods, stocks have historically delivered higher average returns than bonds, compensating investors for higher risks.

7. Income Predictability: Bonds provide regular interest income; stocks may or may not pay dividends, adding to uncertainty.

8. Liquidity: Stocks generally have greater liquidity, allowing quicker buying and selling.

Bonds vs Stocks

BONDS	VS	STOCKS
<ul style="list-style-type: none">Issues of debtDebt that is made with an investor for cash in exchange for payouts of interestTypically traded over the counter (OTC)Generally lower risk, lower rewardSince 1929 have earned around 6% each yearCan be made as corporate, municipal, or treasury bonds		<ul style="list-style-type: none">Issues of a stake of ownership in a companyA claim to a company's assets and earnings that often gives the investor voting rights and pays dividendsTypically traded through a central exchange (like NYSE)Generally higher risk, higher rewardSince 1929 have earned around 10% each yearAre issued by companies at a stock exchange as IPOs

2.9 How Economic Growth Impacts the Reward Potential of Stocks Versus Bonds

1. Stocks and Economic Growth

Direct Relationship: Stock prices reflect the future expected earnings of companies. When the economy grows, companies generally generate higher revenues and profits, boosting their share prices and dividend payouts.

Expansion Benefits: In periods of robust economic growth, consumer demand rises, investment increases, and employment improves—all leading to increased corporate profitability and, therefore, higher potential returns for stock investors.

Compounding Effect: Growth compounds over time, so stocks can offer exponential rewards as reinvested profits generate further growth (the power of compounding).

2. Bonds and Economic Growth

Limited Upside: Bonds provide fixed interest payments regardless of economic conditions. In a growing economy, the coupon and principal remain constant, so bond returns do not increase with corporate or economic growth.

Interest Rate Risk: Central banks may raise interest rates to cool an overheating economy. Rising rates cause existing bond prices to fall, reducing returns for bondholders.

Credit Risk Influence: Economic growth generally lowers default risk for corporate and government bonds as borrowers become financially stronger.

3. Inflation Considerations

Stocks as Inflation Hedges: Economic growth often brings higher inflation. Companies can sometimes pass higher input costs to customers, protecting stock earnings and maintaining real returns.

Bonds Vulnerable to Inflation: Fixed bond payments lose purchasing power during periods of high inflation (unless they are inflation-linked bonds).

4. Long-Term Implications

Stocks Outperform in Growth: Over the long term, economic growth leads to higher aggregate earnings and, consequently, greater total returns in equity markets.

Bonds Provide Stability: Bonds offer stability and preservation of capital but lack the upside associated with expansions in economic output

2.10 The normal distribution

1. Definition and Shape

The normal distribution, also known as the Gaussian distribution, is a continuous probability distribution characterized by its symmetrical bell-shaped curve centered around the mean (average). Most values cluster near the mean, with probabilities tapering off equally on both sides as you move away from the center.

2. Key Parameters

Mean (μ): The central average value of the distribution.

Standard Deviation (σ): Measures the dispersion or spread of data around the mean. Larger σ means more variability.

3. Properties of Normal Distribution

- Symmetric about the mean.
- Approximately 68% of values lie within $\pm 1\sigma$ of the mean.
- About 95% lie within $\pm 2\sigma$, and nearly 99.7% lie within $\pm 3\sigma$ (Empirical Rule).
- The tails extend infinitely in both directions.

4. Relevance to Finance and Investment

Modeling Returns: Stock returns (especially over longer periods) are often assumed to follow a normal distribution, simplifying the calculation of probabilities of gains or losses.

Risk and Return Analysis: Mean represents expected return; standard deviation represents risk or volatility. Many financial models, including the Black-Scholes option pricing model, rely on the assumption of normality.

5. Applications in Portfolio Management

Helps investors estimate the probability of experiencing returns within a certain range.

Facilitates risk assessment and decision-making through the use of standard deviation and confidence intervals.

Supports modern portfolio theory, which models portfolio returns and variances assuming normality.

6. Limitations in Real Markets

Actual stock returns can exhibit fat tails and skewness, meaning extreme events are more frequent than the normal distribution predicts.

Market crises and sudden crashes create deviations from normality (non-Gaussian behavior).

7. Visualizing Normal Distribution

The bell curve peaks at the mean.

Spread (width) depends on the standard deviation.

Probabilities are under the curve areas corresponding to ranges of returns.

8. Practical Example

If a stock has an average daily return of 0.02% and a daily volatility (standard deviation) of 0.75%, then there's roughly a 68% chance the daily return will be between -0.73% and 0.77% (± 1 standard deviation from mean).

9. Importance for Investors

Understanding this distribution enables investors to quantify risks and set expectations for potential portfolio performance, aiding rational investment decisions

2.10.1 How the Normal Distribution Helps in Predicting Stock Market Returns

1. Modeling Returns as a Probability Distribution

The normal distribution assumes stock returns follow a bell-shaped curve where most returns cluster around the average (mean) and the probability of extreme gains or losses decreases symmetrically in both directions. This helps quantify the likelihood of various return outcomes.

2. Quantifying Expected Return and Risk

The mean (average) of the distribution represents the expected return of the stock.

The standard deviation (spread of the curve) measures volatility or risk, indicating how much returns can deviate from the average.

3. Defining Confidence Intervals

Using the properties of normal distribution:

- About 68% of returns fall within ± 1 standard deviation from the mean.
- Approximately 95% fall within ± 2 standard deviations.
- Nearly 99.7% fall within ± 3 standard deviations.

This allows investors to assess the probability of returns falling within certain ranges.

4. Risk Management and Decision Making

By understanding the distribution of possible returns, investors and portfolio managers can: Assess the odds of losses beyond acceptable thresholds. Calculate risk metrics such as Value at Risk (VaR) and potential maximum drawdowns.

Make informed buy/sell decisions based on probabilities of return outcomes.

5. Use in Financial Models

Many models, including the Black-Scholes option pricing model, rely on the assumption of normally distributed returns to calculate fair prices and risk.

6. Standardization and Comparability

Normal distribution allows transforming returns into z-scores, measuring how far a return deviates from the average in standard deviation units, enabling comparisons across different assets and time periods.

7. Simplifies Complex Data

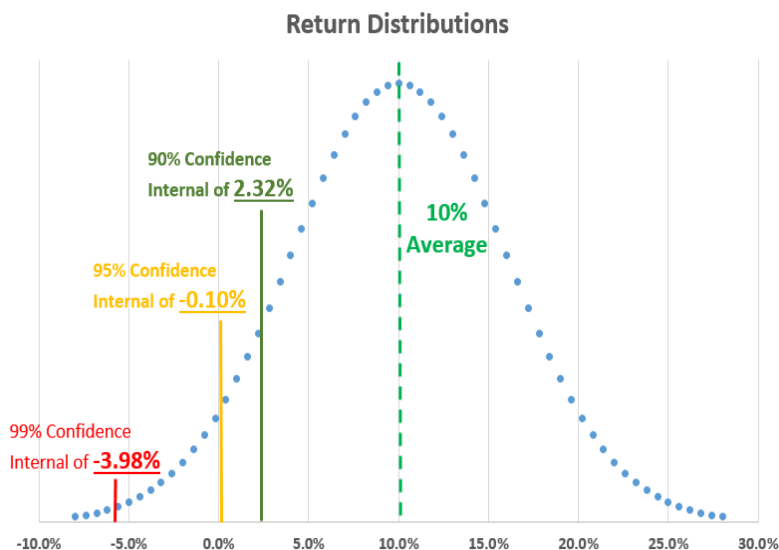
It provides a mathematically tractable and intuitive framework for statistical analysis, enabling easier estimation and optimization in portfolio management.

8. Limitations and Real-world Deviations

Real stock returns sometimes show skewness and fat tails (extreme events

more frequent). Despite this, normal distribution remains a foundational assumption for many practical risk and return forecasts.

2.10.2 Risks of Relying Solely on Normal Distribution in Markets



1. Underestimation of Extreme Events (Fat Tails):

Normal distribution assumes that extreme market moves (large losses or gains) are very rare. However, financial markets often experience “fat tails,” meaning extreme events happen more frequently than predicted by a normal curve. Relying solely on normal distribution may underestimate the probability and impact of market crashes or spikes.

2. Symmetry Assumption:

The normal distribution is symmetric, assuming equal probabilities of gains and losses of similar magnitude. In reality, stock returns can be skewed (asymmetric), with losses often larger and more frequent than gains, affecting risk assessments.

3. Ignoring Market Anomalies:

Events like bubbles, crashes, or sudden shocks do not fit well within a normal distribution framework. Relying on it can lead to ignoring important market patterns and risks.

4. Volatility Clustering:

Normal distribution assumes independent returns over time, but market volatility tends to cluster — periods of high volatility are followed by more of the same, which normal distribution does not account for.

5. Inadequate for Tail Risk Management:

Risk management models that depend entirely on normality may fail to capture tail risk or extreme portfolio losses, leading to insufficient capital reserves or risk controls.

6. Mispricing of Derivatives and Complex Securities:

Many pricing models (e.g., Black-Scholes) assume normal returns; deviations in real markets can cause mispricing and unexpected losses.

7. Overconfidence in Statistical Models:

Heavy reliance on normal distribution can give a false sense of security, leading to under preparedness for market shocks.

2.11 Predicting asset returns

1. Historical Data Analysis

Analyzing past price and return data is a foundational approach. Historical average returns, volatility, and patterns guide predictions for future performance.

2. Statistical and Quantitative Models

Mean-Variance Analysis: Uses means (expected returns) and variances (risk) to optimize portfolios. Time Series Models: Methods like ARIMA, GARCH, and moving averages forecast returns based on past trends and volatility.

3. Fundamental Analysis

Evaluates a company's financial health, earnings, growth prospects, and industry position. For stocks, analyzing financial statements, management quality, and macroeconomic factors aids in estimating future returns.

4. Technical Analysis

Uses chart patterns, price trends, volume data, and momentum indicators

to forecast short-to-medium term returns. Assumes history tends to repeat, and market psychology reveals itself in price action.

5. Factor Models

Models like the CAPM (Capital Asset Pricing Model) and multi-factor models (Fama-French) predict returns based on factors such as market risk (beta), company size, and value/growth characteristics.

6. Economic and Market Forecasting

Macroeconomic indicators (GDP growth, interest rates, inflation) and business cycle analysis help anticipate asset performance by evaluating the economic environment's impact.

7. Forward-Looking Indicators

Dividend yields, earnings forecasts, yield curves, and analyst expectations are used to project potential returns.

8. Monte Carlo Simulation

Simulates thousands of possible return paths based on statistical distributions to estimate a range of likely outcomes.

9. Scenario Analysis and Stress Testing

Examines the effect of various economic scenarios (e.g., recession, boom) on asset returns to gauge risks and resilience.

10. Limitations and Challenges

Predicting returns is inherently uncertain; no model can account for every variable or market shock. Markets are influenced by behavioral factors, sentiment, and unforeseen events, limiting model accuracy.

CHAPTER – III

BOND ANALYSIS AND VALUATION

3.1 Introduction of Bonds

A bond is defined as a debt asset that reflects an investor's loan to a borrower, usually an authority or a firm. When a company issues a bond, it is borrowing money from investors and promising to pay periodic interest payments (coupon payments) and repay the entire principal amount (face value or par value) at the end of the bond's term. Bonds are important for several financial reasons,

- First, frequent coupon payments give investors a constant income stream, making them essential for income-focused strategies.
- Second, because bonds are less volatile than equities, they help investors preserve capital.
- Third, bonds help investors diversify risk across asset types.
- Fourth, bond credit ratings let investors evaluate issuers' creditworthiness, enabling smart investments.
- Lastly, the bond market helps governments and enterprises raise funds for initiatives, promoting prosperity and stability.

3.2 Issuing Bonds

Governments and organisations issue bonds to raise funds. By purchasing a bond, you are making a loan to the issuer, who agrees to repay the face value of the loan on a particular date and to pay you periodic interest payments along the way, usually twice a year. In India, the Central Government issues both Treasury bills and bonds or dated securities, whereas the State Governments exclusively issue bonds or dated securities, known as State Development Loans (SDLs). G-Secs have almost no default risk and are thus referred to as risk-free gilt-edged products.

3.3 Working of Bonds

Bonds function as debt instruments, allowing institutions such as organisations or governments to raise funds by borrowing from investors. Understanding how bonds work involves understanding the

major mechanisms at work about their issue, payment of interest, prices, and maturity. Here's a detailed description of how bonds work,

1. Issuance: The issuer, which might be a government or a firm, decides to raise funds through bond issuance. The issuer determines the bond's face value, coupon rate, maturity date, and other terms.

2. Investors' Purchase: The debt instruments are then promoted for sale to primary market investors. Bonds are purchased by investors at the initial public offering price, which is usually the face value.

3. Payments with Coupons: Bonds give bondholders periodic interest in the form of coupon payments. The coupon rate is determined at the time the bond is issued, and the rate of interest is computed as a proportion of the face value.

4. Price Fluctuations in the Market: The market price of a bond can fluctuate due to a variety of reasons, including fluctuations in rates of interest, economic conditions, and the creditworthiness of the issuer. Existing bonds with cheaper coupon rates can be sold at a discount to their face value if prevailing interest rates rise after the bond is issued.

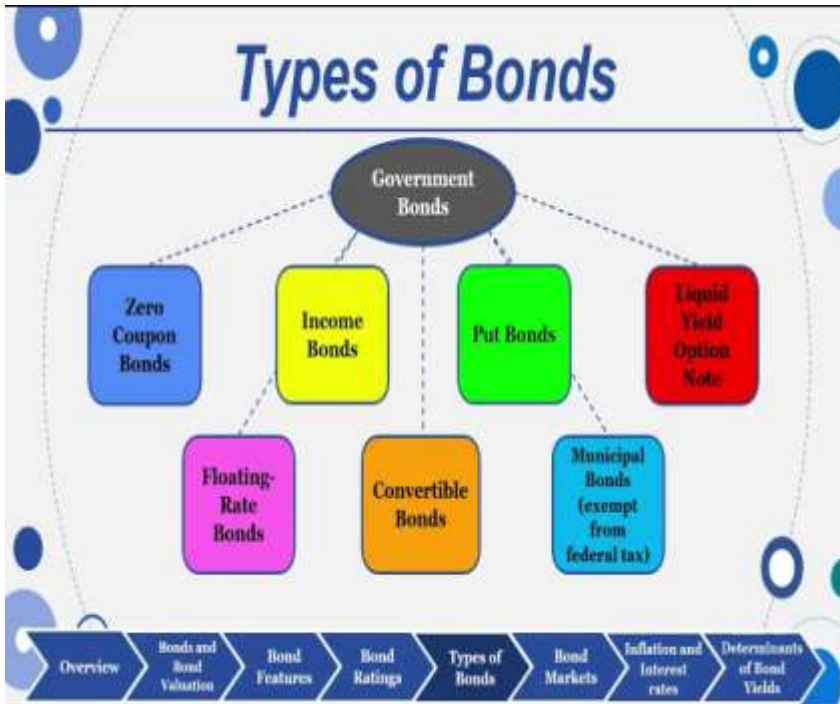
5. Yield: A bond's yield is the effective return an investor receives after accounting for the present market price, coupon payments, and the period to maturity. Yield is calculated as a percentage and may differ from the coupon rate. The yield is different from the coupon rate when a bond moves at a premium or discount.

6. Maturity: Bonds have a predetermined completion date, which is the date on which the issuer repays the bondholders' principal (face value). The bond ceases to exist upon maturity, and the issuer fulfills its duty by paying the principal value to the bondholder.

7. Trading on the Secondary Market: Bonds may be purchased and traded on the secondary market after they have been sold in the primary market. Bondholders who intend to sell their bonds before maturity can do so on the secondary market. The secondary market pricing can be affected by factors such as interest rate movements and the issuer's credit position.

3.4 Categories/Varieties of Bonds

Bonds come in a variety of forms, each customised to certain investor demands or preferences. Here are some examples of bonds,



1. Government Bonds: These are debt securities that are issued by governments to pay public spending. US Treasuries, UK Gilts, and Japanese Government Bonds (JGBs) are a few examples.

2. Municipal Bonds: These are bonds issued by municipal governments or municipalities to support public works projects like schools, roads, and utilities. Municipal bond interest is frequently tax-free.

3. Corporate Bonds: These are bonds that are issued by companies to raise funds for a variety of reasons, such as growth or debt refinancing. Corporate bonds are classed according to their creditworthiness (investment grade or lucrative) and industry.

4. Zero-Coupon Bonds: These kinds of bonds do not pay interest regularly (coupon payments). They are instead issued at a discount to face value and eventually mature at face value. The gap between the buying price and the face value profits investors.

5. Convertible Bonds: Give bondholders the option of converting their bonds into a set number of common stocks of the issuing firm. This enables investors to profit from prospective stock price increases.

6. Floating Rate Bonds: The interest rate on these bonds changes in response to changes in benchmark interest rates. Because the coupon

payments adjust regularly, this helps shield investors from interest rate risk.

7. High-Yield Bonds (Junk Bonds): Issued by lower-rated corporations that are more likely to default. High-yield bonds pay higher interest rates to compensate for the heightened credit risk.

8. Sovereign Bonds: These are bonds that are issued by foreign governments and are priced in a currency other than the investor's home currency. Eurobonds and Samurai Bonds are two examples.

9. Green Bonds: These are bonds that have been issued to fund environmentally beneficial projects. The funds will be used for projects that have a favourable environmental impact, such as renewable energy or sustainable infrastructure.

10. Sukuk (Islamic Bonds): Sukuk are Islamic bonds that indicate investment in a commodity, service, undertaking, or business. The performance of the underlying asset is used to calculate returns.

11. Perpetual Bonds: They have no maturity date and hence pay interest eternally. The principle is not obligated to be redeemed by the issuer. Perpetual bonds are also referred to as "consols."

12. Inflation-Linked Bonds: These bonds are intended to safeguard investors from inflation. The principal amount varies in response to fluctuations in the [Consumer Price Index \(CPI\)](#), to guarantee the investment keeps up with inflation.

13. Callable Bonds: Enables an issuer to redeem the bonds at an agreed-upon call price before maturity. Callable bonds give issuers flexibility, but they expose buyers to the risk of reinvestment if interest rates fall.

14. Foreign Bonds: Bonds issued by foreign governments or companies in the issuing country's currency. Currency risk exists for investors because volatility in currency exchange rates may impact returns.

15. Asset-Backed Securities (ABS): Securities that are secured by a group of assets, such as mortgages or vehicle loans. Payments are made to investors according to the revenue produced by the assets that are being invested.

16. Secured Bonds: Bonds that are collateralised by the issuer's specified assets. Investors have an entitlement to the actual securities if the issuer defaults. Secured bonds include mortgage-backed securities (MBS).

17. Unsecured bonds (Debentures): Unsecured bonds are those that are not secured by specific collateral. Rather, they depend on the overall creditworthiness of the issuer. Debentures are a sort of unsecured bond that is commonly used.

3.5 Types of Bonds

1. Bonds with Fixed Interest Rates: Fixed-rate bonds pay continuous payments until they mature. Bondholders receive consistent and guaranteed returns regardless of market conditions. For example, on April 20, 2003, an investor purchased a ₹ 1000 ten-year fixed-rate government bond with a coupon rate of 7.5%. The investor would receive a fixed interest of ₹ 75 each year until April 20th, 2013.

2. Bonds with Floating Interest Rates: Floating-rate bonds do not provide consistent returns. Instead, interest rates fluctuate throughout time depending on the benchmark. For example, in 2015, a customer purchased an 8-year variable rate bond. The bond pays 40 basis points more than the current National Savings Certificate interest rate. This means that the NSC interest rate is the benchmark, and any changes in it have a direct impact on the coupon payment of this bond.

3. Bonds with No Coupon: These bonds, as the name implies, do not pay regular coupons throughout their tenure. These bonds, however, have been issued at a discount and are repaid at the par value. The return for investors is the difference. For example, suppose an investor pays ₹ 700 for a 20-year zero-coupon bond with an initial value of ₹ 1000. The issuer will pay the bondholder Rs. 1000 at the end of 20 years.

4. Permanent Bonds: Perpetual bonds are debt securities that have no maturity date. The issuer does not refund the principal amount to the bondholders under this form of bond. Nonetheless, they continue to provide consistent coupon payments to bondholders in perpetuity.

5. Bonds Linked to Inflation: These bonds are designed to reduce the impact of inflation on the face value and coupon payments. The principle is updated for inflation, and coupon payments are calculated using the adjusted principal. For instance, suppose an investor buys an inflation-linked bond with a face value of ₹ 100. The inflation-adjusted principle after a year is ₹ 107. As a result, the coupon will be calculated using ₹ 107 for that period.

6. Convertible Bond: Convertible bondholders have the right to convert the bond into an agreed-upon amount of equity shares in the issuing firm at a specified period during the lifespan. If the investor is not willing to swap the principal for shares, they can choose to receive it at maturity.

7. Callable Bonds: Callable bonds are high-yielding securities that provide the issuer the right to call the bonds back at a predetermined price and date.

8. Puttable Bonds: Puttable bonds allow the bondholder to forfeit the bond and request a return of principal at a predetermined date before maturity. Because the advantage provided is for buyers, the returns on these bonds are smaller.

3.6 Why Should You Buy Bonds?

Bonds are issued by governments and enterprises to raise funds. By purchasing a bond, you are making a loan to the issuer, who agrees to repay the face value of the loan on a particular date and to pay you interest at regular intervals, usually twice a year. Unlike stocks, corporate bonds provide you with no ownership rights. So you don't necessarily gain from the firm's development, but you also don't see as big of an effect when the business isn't doing so well as long as it still has the wherewithal to keep its loans current. Bonds, as part of your [portfolio](#), can provide you with two potential benefits, they provide a steady stream of income while mitigating some of the risk associated with stock ownership.

3.7 Advantages of Investing in Bonds

Bond investing has various advantages, making it an appealing alternative for a wide range of investors. Here are some important benefits of bond investing,

1. Consistent Income Stream: Bonds pay bondholders recurring interest, known as coupon payments. This consistent income stream is especially enticing to revenue-focused investors, such as retirees, who rely on consistent cash flow.

2. Capital Preservation: Bonds are often thought to be less hazardous than stocks and are often regarded as a more conservative investment. The restoration of principal at maturity protects capital, particularly for bonds issued by reliable organisations.

3. Diversification: Bonds can be quite useful in diversifying an investing portfolio. They frequently have little to no association with stocks, which means they may react significantly to market conditions. Bonds in a well-diversified portfolio can help to minimise overall portfolio risk.

4. Security and Safety: Government bonds, particularly those that are issued by financially sound governments, are regarded as among the safest investments. Even corporate bonds issued by respectable corporations with excellent credit ratings might give some protection when compared to riskier assets.

5. Predictable Returns: Fixed-income products, such as bonds, have a known interest rate, allowing investors to calculate and forecast their future returns. This regularity might be advantageous in terms of financial preparation and investment strategy.

6. Variety of Options: Bonds are available in a variety of formats, such as bonds issued by governments, bonds for municipalities, corporate bonds, and convertible bonds. This variety allows investors to select bonds that match their risk tolerance, income requirements, and investment objectives.

7. Potential for Capital Appreciation: While bonds' primary job is to pay income, they can also bring capital appreciation. If market interest rates fall after a bond has been issued, the present bond may become more appealing, potentially leading to a price increase.

8. Liquidity: Bonds are frequently traded in the secondary market, which provides investors with liquidity. This means that investors can readily acquire and sell bonds, particularly government and high-quality business bonds.

9. Tax Benefits: Certain forms of bonds, like municipal bonds, may provide tax benefits. Municipal bond interest income is frequently excluded from the government's income tax, and in some situations, it may also be exempt from state and local taxes.

3.8 Factors Affecting Bond Prices

For initial investors who want to retain bonds until maturity, the market value is unimportant because they will get regular interest and subsequently the principal amount at maturity. The market value is critical for investors who want to acquire and sell securities on the

secondary market. The following are some of the elements that impact bond prices,

1. Rates of Interest: There is an inverse correlation between bond valuation and market interest rates. The net present value of a bond is computed using the current interest rate on the market as the discount rate. When the discount rate on a bond rises, the market interest rate rises, and the discount rate on cash flow rises the bond's value declines. When the bond interest rate falls, the value of the bonds rises as the related future cash flows are discounted. This leads to a greater bond value.

2. Maturity of Bonds: Long-term bond prices, which have a longer maturity date, are prone to move based on interest rates. Bond valuations decrease faster for bonds with longer maturity periods as interest rates rise than for bonds with shorter maturities. This is often referred to as the bond term factor.

3. Bond Credit Score: The credit risk profile of an issuer is determined by the bond credit rating. This is offered by organisations such as [CRISIL](#), CARE, and ICRA and is denoted as AAA, AA, and A in decreasing order in terms of financial strength. A high-credit-rating issuer will usually be able to service the bond's coupon payments and principal payments on time. The greater the yields, the poorer the credit ratings. As a result, investors are more ready to invest in low-rated bonds. When a bond's credit rating changes, so does its price. A poor credit rating reduces the value of a bond, whereas higher yields enhance its profit. A high credit rating, on the other hand, will increase the bond's value while decreasing its yield. As a result, before investing in bonds, investors must conduct adequate research on the issuer and comprehend its financial strength.

4. Structure of Bonds: The price of a bond might vary depending on the bond's structure. A floating rate coupon bond, for example, does not move as much with interest rates as a fixed coupon rate bond. Furthermore, Call and Put Options can affect bond pricing as maturity approaches. A Call Option is one in which the issuer has the right to redeem a bond before its final maturity, whereas a Put Option is one in which the bondholder has the right to demand repayment before maturity.

5. Market Situation: Bond prices can be influenced by broad market conditions. When the shares are rising and the country's economy is performing well, it is usual for investors to shift their money away from bonds and into equities. When equities markets experience a correction or collapse, investors become risk cautious and migrate to the greater security of bonds, causing bond prices to climb.

6. Inflation: Bond prices generally fall during times of inflation. This is due to investors' need for higher yields to make up for inflation. Bond prices, on the other hand, tend to climb during periods of declining inflation.

3.9 Taxation on Bonds

Bonds provide income to investors in two ways: interest and capital appreciation. In India, the following are the tax structures for various bonds

GoldenPI Invest
Knowledge Centre for Bonds and Alternatives

HOW ARE BONDS TAXED?

- Interest**
Fixed payment on investment
Taxed as income at slab rates
- Capital Gains**
LTCG (Long-term): >12 months
(10% for listed, 20% for unlisted)
STCG (Short-term): <12 months (Taxed per slab)
- Other Bonds**
Tax-free bonds: Tax-free interest
Tax-saving bonds: LTCG exempt, interest taxed
Zero coupon bonds: No interest, taxed for gains
Market-linked bonds: Taxed based on performance

<https://goldenpi.com/blog/essentials/how-are-bonds-taxed/>

1. Regular Taxable Bonds: These bonds are taxable, as the name implies. These bonds can make you money in two ways, capital gains and interest. Income generated by the investor at the point of maturity is

referred to as capital gains. Capital gains are the difference in price between the sale and acquisition prices of bonds. Individuals earn interest on bonds, which is added to their gross total income and taxed at the applicable slab rate.

2. Tax-Exempt Bonds: Ministries and PSUs issue such bonds to raise funding for a variety of national-importance initiatives. Tax-free bonds are issued by the government to fund infrastructural and welfare-related projects like as roadways, transportation systems, harbors, development of towns and villages, and so on. The interest generated from these is tax-free for investors. However, based on the holding duration, the returns obtained from these bonds upon maturation or sale are classified as LTCG or STCG.

3. Tax-Saving Bonds: Individuals who own any long-term capital asset, such as land or a building, can save money on taxes by investing in these bonds. They can reinvest the revenues from the sale of these assets in 54EC bonds. These bonds provide complete LTCG tax exemption. This tax benefit, however, will only be available if the interval between sale and investment is less than 6 months. These can result in capital gains for investors. Capital gains are taxed as either LTCG or STCG. The government also permits investment deductions of up to ₹ 20,000 per year. It is more than the ₹ 1.5 lakhs deduction under Section 80C. 54EC bonds can be issued by NHAI, REC, and PFC.

4. Zero Coupon Bonds: A coupon is the interest that investors receive when they invest in a bond. Zero coupon bonds do not pay interest but can be purchased at a significant discount. On maturity, the investor gets the full face value. Because there is no recurring interest payment, there is no interest tax. Capital gains can be earned by investors; capital gains are taxed as LTCG or STCG. These bonds can only be issued by NABARD, REC, and certain government agencies.

3.10 Management Portfolios

3.10.1 Passive management Portfolio

Passive portfolio management can be called [index fund](#) management. A passive portfolio manager buys only the stocks that are listed on an index and sells shares only when the stock is removed from the index or its weighting in the index is reduced.

Passive Portfolio Management Strategies



**Index
Investing**



**Asset
Allocation**



**Buy-And-Hold
Investing**



This is because a passive portfolio is typically designed to parallel the returns of a particular [market index](#) or benchmark as closely as possible. Each stock listed on an index is weighted. That is, it represents a percentage of the index that is commensurate with its size and influence in the real world. The creator of an index portfolio will use the same weights. The purpose of passive portfolio management is to generate a return that is the same as the chosen index. A passive strategy does not have a management team making investment decisions and can be structured as an exchange-traded fund (ETF), a mutual fund, or a [unit investment trust](#) (UIT). Index funds are branded as passively managed rather than unmanaged because each has a portfolio manager who is in charge of replicating the index. Because this investment strategy is not proactive, the management fees assessed on passive portfolios or funds are often far lower than active management strategies.

Advantages of Passive portfolio management:

- **Low Costs:** Passive portfolio management typically involves lower fees and expenses compared to active management since trades are limited in nature and analysis is only to the extent of what is comprised in the benchmark index - so transaction costs are minimal.

- **Consistency:** Passive portfolio management provide consistent exposure to the broader market, reducing the impact of market fluctuations on the portfolio's performance.
- **Tax Efficient:** Less trading also means less short term capital gains are incurred which means, passive portfolios are more tax-efficient than active portfolios
- **Diversification:** Since investing in passive portfolio management strategies involves adding constituents that are the same as the benchmark or the market index, it inherently provides higher diversification benefits
- **Accessibility:** Index funds and exchange-traded funds (ETFs) both use passive portfolio management strategies that are widely available, easily accessible and have lower minimum investment requirements - as low as Rs.500 for some SIPs.

Disadvantages of Passive portfolio management:

- **Not built for Outperformance:** Passive funds aim to match the benchmark index's return but will in most cases never outperform it since the passive portfolio strategy just copies the index
- **Lack of Customization:** Each passive fund is built targeting a specific index like the Nifty50 which looks at the top 50 stocks in Nifty or Nifty Smallcap 100 which looks at the top 100 smallcaps stocks in the Nifty. As such, investor's specific needs and preferences cannot be catered to with an index as there is no room for customization

3.10.2 Active management Portfolio

What is Active Management?



The investor who follows an active portfolio management strategy buys and sells stocks in an attempt to outperform an index such as the [Standard & Poor's 500](#) or the Russell 1000 Index. An actively managed investment fund has an individual portfolio manager, co-managers, or a team of managers all making investment decisions for the fund. The success of the fund depends on in-depth research, market forecasting, and the expertise of the management team. Portfolio managers engaged in active investing follow market trends, shifts in the economy, changes to the political landscape, and any other factors that may affect specific companies. This data is used to time the purchase or sale of assets. Proponents of active management claim that these processes can result in higher returns than can be achieved by simply mimicking the stocks listed on an index.

Advantages of Active Portfolio Management

- **Potential for Higher Returns:** Active portfolio strategy managers exploit market inefficiencies, select high-performing securities, and time their trades to beat the market
- **Tailored Strategies:** Based on the investor's specific investment goals, risk tolerance, and overall market trends, Active portfolio strategy managers can create customized portfolios that suit the investor
- **Flexibility:** Active portfolio strategy managers can quickly adapt to changing market conditions, reallocate assets away from riskier to safer assets or vice versa, and accordingly select securities and assets
- **Risk Management:** Quicker response time from active portfolio strategy managers, means they can respond to market conditions faster than passive managers and can even, reduce risk by re-adjusting allocations to more conservative investments. All of this may help minimize losses during market downturns.
- **Tax Considerations:** Active portfolio strategy managers can time selling assets and securities that are in their portfolio to reduce capital gains or employ loss-harvesting strategies for getting tax benefits.

Disadvantages of Active Portfolio Management

- **Higher Costs:** Actively managed portfolios often have higher trading costs due to frequent transactions.
- **Limited Flexibility in Mutual Funds:** Actively managed mutual funds may have constraints that limit the manager's ability to pivot or adapt to market changes.

Key Difference Between Active and Passive Portfolio Management



Active Management	Passive Management
Attempts to beat benchmark performance	Attempts to match benchmark performance
Contends pricing inefficiencies in the market create investing opportunities	Contends that it is difficult or impossible to "beat the market"
Securities selected by portfolio manager	Securities selected based on an index
Focuses on choice of	Focuses on overall sector or asset class

Active Management	Passive Management
specific securities and timing of trades	
Trading and the degree of liquidity for individual securities may increase portfolio costs	Infrequent trading tends to minimize portfolio expenses

3.11 Definition of bond valuation

Bond valuation helps investors compare the value of a bond's future payments with other investments. Bond valuation determines the present value of a bond's future interest payments, also known as its cash flow, and the bond's value upon [maturity](#), also known as its face value or [par value](#). A bond's par value and interest payments are fixed. Bond valuation helps investors determine what rate of return makes a bond investment worth the cost.

3.11.1 Understanding Bond Valuation

A bond is a debt instrument that provides a steady income stream to the investor in the form of [coupon payments](#). At the maturity date, the full face value of the bond is repaid to the bondholder. The characteristics of a regular bond include:

- **Coupon rate:** Some bonds have an interest rate, also known as the coupon rate, which is paid to bondholders semiannually. The coupon rate is the fixed return that an investor earns periodically until it matures.

Maturity date: All bonds have maturity dates, some short-term, others long-term. When a bond matures, the bond issuer repays the investor the full [face value](#) of the bond. For corporate bonds, the face value of a bond is usually \$1,000, and for government bonds, the face value is \$10,000.

The face value is not necessarily the invested principal or purchase price of the bond.

Current price: Depending on the level of interest rate in the environment, the investor may purchase a bond at par, below par, or above par. For example, if interest rates increase, the value of a bond will decrease since the coupon rate will be lower than the interest rate in the economy. When this occurs, the bond will trade at a discount, that is, below par. However, the bondholder will be paid the full face value of the bond at maturity even though they purchased it for less than the par value.

3.11.2 Bond Valuation in Practice

Since bonds are an essential part of the capital markets, investors and analysts seek to understand how the different features of a bond interact to determine its intrinsic value. Like a stock, the value of a bond determines whether it is a suitable investment for a portfolio and, hence, is an integral step in bond investing. Bond valuation, in effect, is calculating the present value of a bond's expected future coupon payments. The theoretical fair value of a bond is calculated by discounting the future value of its coupon payments by an appropriate discount rate. The discount rate used is the yield to maturity, which is the rate of return that an investor will get if they reinvest every coupon payment from the bond at a fixed interest rate until the bond matures. It takes into account the price of a bond, par value, coupon rate, and time to maturity.

Coupon Bond Valuation

Calculating the value of a coupon bond factors in the annual or semi-annual coupon payment and the par value of the bond.

The present value of expected cash flows is added to the present value of the face value of the bond as seen in the following formula:

$V_{\text{coupons}} = \sum C(1+r)^{-t}$ $V_{\text{face value}} = F(1+r)^{-T}$ where: C =future cash flows, that is, coupon payments r =discount rate, that is, yield to maturity F =face value

e of the bond t = number of periods T = time to maturity V coupons = $\sum (1+r)^t C$
 V face value = $(1+r)^T F$

where: C = future cash flows, that is, coupon payments r = discount rate, that is, yield to maturity F = face value of the bond t = number of periods T = time to maturity

For example, let's find the value of a corporate bond with an annual interest rate of 5%, making semi-annual interest payments for two years, after which the bond matures and the principal must be repaid. Assume a YTM of 3%:

- $F = \$1,000$ for corporate bond
 - Coupon rate_{annual} = 5%, therefore, Coupon rate_{semi-annual} = 5% / 2 = 2.5%
 - $C = 2.5\% \times \$1000 = \25 per period
 - $t = 2 \text{ years} \times 2 = 4$ periods for semi-annual coupon payments
 - $T = 4$ periods
 - $r = \text{YTM of } 3\% / 2 \text{ for semi-annual compounding} = 1.5\%$
1. Present value of semi-annual payments = $25 / (1.015)^1 + 25 / (1.015)^2 + 25 / (1.015)^3 + 25 / (1.015)^4 = 96.36$
 2. Present value of face value = $1000 / (1.015)^4 = 942.18$

Therefore, the value of the bond is \$1,038.54.

Zero-Coupon Bond Valuation

A zero-coupon bond makes no annual or semi-annual coupon payments for the duration of the bond. Instead, it is sold at a deep discount to par when issued. The difference between the purchase price and par value is the investor's interest earned on the bond.

To calculate the value of a zero-coupon bond, we only need to find the present value of the face value. Carrying over from the example above, the value of a zero-coupon bond with a face value of \$1,000, YTM of 3%, and two years to maturity would be $\$1,000 / (1.03)^2$, or \$942.59.

Price of Bond is Different From Its Face Value

A bond's face or par value will often differ from its market value. This has to do with several factors including changes to interest rates, a company's credit rating, time to maturity, whether there are any call provisions or other embedded options, and whether the bond is secured or unsecured. A bond will always mature at its face value when the principal originally loaned is returned.

Bond Prices Inversely Related to Interest Rates

A bond that pays a fixed coupon will see its price vary inversely with interest rates. This is because receiving a fixed interest rate, of say 5% is not very attractive if prevailing interest rates are 6%, and becomes even less desirable if rates can earn 7%. In order for that bond paying 5% to become equivalent to a new bond paying 7%, it must trade at a discounted price. Likewise, if interest rates drop to 4% or 3%, that 5% coupon becomes quite attractive and so that bond will trade at a premium to newly-issued bonds that offer a lower coupon.

Duration and the Affect of Bond Valuation

Bond valuation looks at discounted cash flows at their net present value if held to maturity. Duration instead measures a bond's price sensitivity to a 1% change in interest rates. Longer-term bonds have a higher duration, all else equal. Longer-term bonds will also have a larger number of future cash flows to discount, and so a change to the discount rate will have a greater impact on the NPV of longer-maturity bonds as well.

Value of Convertible Bonds

A convertible bond is a debt instrument that has an embedded option that allows investors to convert the bonds into shares of the company's common stock. Convertible bond valuations take a multitude of factors into account, including the variance in underlying stock price, the conversion ratio, and interest rates that could affect the stocks that such bonds might eventually become. At its most basic, the convertible is

priced as the sum of the straight bond and the value of the embedded option to convert.

The Bottom Line

Bond valuation is an important tool for investors in order to determine the fair value of a bond. Investors analyze coupon payments, yield to maturity, and face value to understand if the return on the bond is acceptable, which helps inform investment decisions. Investors also take into consideration present value, future payments, interest rates, and the state of the economy to help make an assessment.

CHAPTER IV

THEORY FOR INVESTMENT PORTFOLIO FORMATION

Introduction to Investment and Portfolio Formation

Introduction:

Investment is the employment of funds on assets with the aim of earning income or capital appreciation. Investment has two attributes namely time and risk. Present consumption is sacrificed to get a return in the future. The sacrifice that has to be borne is certain but the return in the future may be uncertain. This attribute of investment indicates the risk factor. The risk is undertaken with a view to reap some return from the investment. For a layman, investment means some monetary commitment. A person's commitment to buy a flat or a house for his personal use may be an investment from his point of view. This cannot be considered as an actual investment as it involves sacrifice but does not yield any financial return. To the economist, investment is the net addition made to the nation's capital stock that consists of goods and services that are used in the production process. A net addition to the capital stock means an increase in the buildings, equipment or inventories. These capital stocks are used to produce other goods and services. Financial investment is the allocation of money of assets that are expected to yield some gain over a period of time. It is an exchange of financial claims such as stocks and bonds for money. They are expected to yield returns and experience capital growth over the years. The financial and economic meanings are related to each other because the savings of the individual flow into the capital market as financial investments, to be used in economic investment. Even though they are related to each other, we are concerned only about the financial investment made on securities. Thus, investment may be defined as "a commitment of funds made in the expectation of some positive rate of return". Expectation of return is an essential element of investment. Since the return is expected to be realized in future, there is a possibility that the return actually realized is lower than the return expected to be realized. This possibility of variation in the actual return is known as investment risk. Thus, every investment involves return and risk.

Characteristics of Investment:

All investments are characterized by certain features. Let us analyse these characteristic features of investment.

Return:

All investments are characterized by the expectation of a return. In fact, investments are made with the primary objective of deriving a return. The return may be received in the form of yield plus capital appreciation. The difference between the sale price and the purchase price is capital appreciation. The dividend or interest received from the investment is the yield. Different types of investments promise different rates of return. The return from an investment depends upon the nature of the investment, the maturity period and a host of other factors.

Risk:

Risk is inherent in any investment. This risk may relate to loss of capital, delay in repayment of capital, non-payment of interest, or variability of returns. While some investments like government securities and bank deposits are almost riskless, others are more risky

The risk of an investment depends on the following factors

1. The longer the maturity period, the larger is the risk.
2. The lower the credit worthiness of the borrower, the higher is the risk.
3. The risk varies with the nature of investment. Investments in ownership securities like equity shares carry higher risk compared to investments in debt instruments like debentures and bonds.

Risk and return of an investment are related. Normally, the higher the risk, the higher is the return.

Safety: The safety of an investment implies the certainty of return of capital without loss of money or time. Safety is another feature which an investor desires for his investments. Every investor expects to get back his capital on maturity without loss and without delay

Liquidity:

An investment which is easily saleable or marketable without loss of money and without loss of time is said to possess liquidity. Some investments like company deposits, bank deposits, P.O. Deposits, NSC, NSS, etc. are not marketable. Some investment instruments like preference shares and debentures are marketable, but there are no buyers in many cases and hence their liquidity is negligible. Equity shares of companies listed on stock exchanges are easily marketable through the stock exchanges. An investor generally prefers liquidity for his investments, safety of his funds, a good return with minimum risk or minimization of risk and maximization of return.

Objectives of Investment:

An investor has various alternative avenues of investment for his savings to flow to. Savings kept as cash are barren and do not earn anything. Hence, savings are invested in assets depending on their risk and return characteristics. The objectives of the investor are minimizing the risk involved in investment and maximize the return from the investment.

Our savings kept as cash are not only barren because they do not earn anything, but also loses its value to the extent of rise in prices. Thus, rise in prices or inflation erodes the value of money. Savings are invested to provide a hedge or protection against inflation. If the investment cannot earn as much as the rise in prices, the real rate of return would be negative. Thus, if inflation is at an average annual rate of ten percent, then the return from an investment should be above ten percent to induce savings to flow into investment.

Thus, the objectives of an investor can be stated as:

- ❖ Maximisation of return.
- ❖ Minimization of risk
- ❖ Hedge against inflation.

Investors, in general, desire to earn as large returns as possible with the minimum of risk. Risk here may be understood as the probability that actual returns realized from an investment may be different from the

expected return. If we consider the financial assets available for investment, we can classify them into different risk categories. Government securities would constitute the low risk category as they are practically risk free. Debentures and preference shares of companies may be classified as medium risk assets. Equity shares of companies would form the high risk category of financial assets. An investor would be prepared to assume higher risk only if he expects to get proportionately higher returns. There is a trade-off between risk and return. The expected return of an investment is directly proportional to its risk. Thus, in the financial market, there are different financial assets with varying risk-return combinations.

Investment Vs Speculation:

Investment and speculation are two terms which are closely related. Both involve purchase of assets like shares and securities. Traditionally, investment is distinguished from speculation with respect to three factors, viz. (1) risk, (2) capital gain and (3) time period.

Risk:

It refers to the possibility of incurring a loss in a financial transaction. It arises from the possibility of variation in returns from an investment. Risk is invariably related to return. Higher return is associated with higher risk. No investment is completely risk free. An investor generally commits his funds to low risk investment, whereas a speculator commits his funds to higher risk investments. A speculator is prepared to take higher risks in order to achieve higher returns.

Capital Gain:

The speculator's motive is to achieve profits through price changes, i.e. he is interested in capital gains rather than the income from the investment. If purchase of securities is preceded by proper investigation and analysis to receive a stable return and capital appreciation over a period of time, it is investment. Thus, speculation is associated with buying low and selling high with the hope of making large capital gains. A speculator consequently engages in frequent buying and selling transactions.

Time Period:

Investment is long-term in nature, whereas speculation is short-term. An investor commits his funds for a longer period and waits for his return. But a speculator is interested in short-term trade gains through buying and selling of investment instruments. Analysis of these distinctions helps us to identify the role of an investor and a speculator. An investor is interested in a good rate of return earned on a rather consistent basis for a relatively longer period of time. He evaluates the worth of a security before investing in it. A speculator seeks opportunities promising very large returns earned rather quickly. He is interested in market action and price movements. Consequently, speculation is more risky than investment. Basically, both investment and speculation aim at good returns. The difference is in motives and methods. As a result, the distinction between investment and speculation is not very wide. Investment is sometimes described as a well grounded and carefully planned speculation.

Investment Vs Gambling:

Investment has also to be distinguished from gambling. Typical examples of gambling are horse races, card games, lotteries, etc. Gambling consists in taking high risks not only for high returns, but also for thrill and excitement. Gambling is unplanned and non scientific, without knowledge of the nature of the risk involved. It is surrounded by uncertainty and is based on tips and rumors. In gambling artificial and unnecessary risks are created for increasing the returns. Investment is an attempt to carefully plan, evaluate and allocate funds to various investment outlets which offer safety of principal and moderate and continuous return over a long period of time. Gambling is quite the opposite of investment.

Types of Investors:

Investors may be individuals and institutions. Individual investors operate alongside institutional investors in the investment arena. However, their characteristics are different.

Individual investors are large in number but their investable resources are comparatively smaller. They generally lack the skill to carry out extensive

evaluation and analysis before investing. Moreover, they do not have the time and resources to engage in such an analysis. Institutional investors, on the other hand, are the organizations with surplus funds who engage in investment activities. Mutual funds, investment companies, banking and non-banking companies, insurance corporations, etc. are the organizations with large amounts of surplus funds to be invested in various profitable avenues.

These institutional investors are fewer in number compared to individual investors, but their investable resources are much larger. The institutional investors engage professional fund managers to carry out extensive analysis and evaluation of different investment opportunities. As a result their investment activity tends to be more rational and scientific. They have a better chance of maximizing returns and minimizing risk. The professional investors and the unskilled individual investors combine to make the investment arena dynamic.

Investment Avenues:

There are a large number of investment avenues for savers in India. Some of them are marketable and liquid while others are non marketable. Some of them are highly risky while some others are almost riskless. The investor has to choose proper avenues from among them depending on his preferences, needs and ability to assume risk.

1. Corporate securities
2. Deposits in banks and non-banking companies
3. UTI and other mutual fund schemes
4. Post office deposits and certificates
5. Life insurance policies
6. Provident fund schemes
7. Government and semi-government securities.

Corporate Securities:

Corporate securities are the securities issued by joint stock companies in the private sector. These include equity shares, preference shares and debentures. Equity shares have variable dividend and hence belong to the

high risk-high return category, while preference shares and debentures have fixed returns with lower risk.

Deposits:

Among the non-corporate investments, the most popular are deposits with banks such as savings accounts and fixed deposits. Savings deposits have low interest rates whereas fixed deposits have higher interest rates varying with the period of maturity. Interest is payable quarterly or half-yearly. Fixed deposits may also be recurring deposits wherein savings are deposited at regular intervals. Some banks have reinvestment plans wherein the interest is reinvested as it gets accrued. The principal and accumulated interests are paid on maturity. Joint stock companies also accept fixed deposits from the public. The maturity period varies from three to five years. Fixed deposits in companies have high risk since they are unsecured, but they promise higher returns than bank deposits. Fixed deposit in non-banking financial companies (NBFCs) is another investment avenue open to savers. NBFCs include leasing companies, investment companies, chit funds, etc. Deposits in NSFCs carry higher returns with higher risk compared to bank deposits.

UTI and Other Mutual Fund Schemes:

Mutual funds offer various investment schemes to investors. UTI is the oldest and the largest mutual fund in the country. Unit Scheme 1964, Unit Linked Insurance Plan 1971, Master Share, Master Equity Plans, Master gain, etc. are some of the popular schemes of UTI. A number of commercial banks and financial institutions have set up mutual funds. Recently mutual funds have been set up in the private sector also.

Post Office Deposits and Certificates:

The investment avenues provided by post offices are generally non-marketable. Moreover, the major investments in post office enjoy tax concessions also. Post office accepts savings deposits as well as fixed deposits from the public. There is also recurring deposit scheme which is an instrument of regular monthly savings.

Six-year National Savings Certificates (NSC) are issued by post office to investors. The interest on the amount invested is compounded half-yearly and to payable along with the principal at the time of maturity which is six years from the date of issue. Indira Vikas Patra and Kissan Vikas Patra are savings certificates issued by post officers.

Life Insurance Policies:

The Life Insurance Corporation (LIC) offers many investment schemes to investors. These schemes have the additional facility of life insurance cover. Some of the schemes of LIC are whole Life Policies, Convertible Whole Life Assurance Policies, Endowment Assurance Policies, Jeevan Saathi, Money Back Plan, Jeevan Dhara, Marriage Endowment Plan etc.

Provident Fund Schemes:

Provident fund schemes are compulsory deposit schemes applicable to employees in the public and private sectors. There are three kinds of provident funds applicable to different sectors of employment, namely Statutory Provident Fund, Recognised Provident Fund and Unrecognised Provident Fund. In addition to these, there is a voluntary provident fund scheme which is open to any investor whether employed or not. This is known as the Public Provident Fund (PPF). Any member of the public can join the scheme which is operated by the post offices and the State Bank of India.

Government and Semi-Government Securities:

The government and semi-Government bodies like the public sector undertakings borrow money from the public through the issue of government securities and public sector bonds. These are less risky avenues of investment because of the credibility of the government and government undertakings.

Portfolio Analysis:

Introduction:

Individual securities have risk return characteristics of their own. The future return expected from a security is variable and this variability of

returns is termed risk. It is rare to find investors investing their entire wealth in a single security. This is because most investors have an aversion to risk. It is hoped that if money is invested in several securities simultaneously, the loss in one will be compensated by the gain in others. Thus, holding more than one security at a time is an attempt to spread and minimize risk by not putting all our eggs in one basket.

Most investors thus tend to invest in a group of securities rather than a single security. Such a group of securities held together as an investment is what is known as a portfolio. The process of creating such a portfolio is called diversification. It is an attempt to spread and minimize the risk in investment. This is sought to be achieved by holding different types of securities across different industry groups.

From a given set of securities, any number of portfolios can be constructed. A rational investor attempts to find the most efficient of these portfolios. The efficiency of each portfolio can be evaluated only in terms of the expected return and risk of the portfolio as such. Thus, determining the expected return and risk of different portfolios is a primary step in portfolio management. This step is designated as portfolio analysis.

Expected Return of a Portfolio:

As a first step in portfolio analysis, an investor needs to specify the list of securities eligible for selection or inclusion in the portfolio. Next he has to generate the risk-return expectations for these securities. These are typically expressed as the expected rate of return (mean) and the variance or standard deviation of the return.

The expected return of a portfolio of assets is simply the weighted average of the return of the individual securities held in the portfolio. The weight applied to each return is the fraction of the portfolio invested in that security.

Let us consider a portfolio of two equity shares P and Q with expected returns of 15 per cent and 20 per cent respectively.

If 40 per cent of the total funds are invested in share P and the remaining 60 per cent, in share Q, then the expected portfolio return will be:

$$(0.40 \times 15) + (0.60 \times 20) = 18 \text{ per cent}$$

The formula for the calculation of expected portfolio return may be expressed as shown below:

$$r_p = \sum_{i=1}^n x_i r_i$$

Where:

r_p = Expected return of the portfolio

x_i = Proportion of funds invested in security i .

r_i = Expected return of security i .

n = Number of securities in the portfolio

Risk of a Portfolio:

The variance of return and standard deviation of return are alternative statistical measures that are used for measuring risk in investment. These statistics measure the extent to which returns are expected to vary around an average over time. The calculation of variance of a portfolio is a little more difficult than determining its expected return.

The variance or standard deviation of an individual security measures the riskiness of a security in absolute sense. For calculating the risk of a portfolio of securities, the riskiness of each security within the context of the overall portfolio has to be considered. This depends on their interactive risk, i.e. how the returns of a security move with the returns of other securities in the portfolio and contribute to the overall risk of the portfolio.

Covariance is the statistical measure that indicates the interactive risk of a security relative to others in a portfolio of securities. In other words, the way security returns vary with each other affects the overall risk of the portfolio. The covariance between two securities X and Y may be calculated using the following formula:

$$\text{Cov}_{xy} = \frac{[R_x - \bar{R}_x] [R_y - \bar{R}_y]}{N}$$

Cov_{xy} = Covariance between x and y.

R_x = Return of security x.

R_y = Return of security y

\bar{R}_x = Expected or mean return of security x.

\bar{R}_y = Expected or mean return of security y.

N = Number of observations.

The calculation of covariance is illustrated below:

Calculation of Covariance:

$$\text{Cov}_{xy} = \frac{[R_x - \bar{R}_x] [R_y - \bar{R}_y]}{N}$$

$$= -42 / 4 = -$$

The covariance is a measure of how returns of two securities move together. If the returns of the two securities move in the same direction consistently the covariance would be positive. If the returns of the two securities move in opposite direction consistently the covariance would be negative. If the movements of returns are independent of each other, covariance would be close to zero.

Covariance is an absolute measure of interactive risk between two securities. To facilitate comparison, covariance can be standardized. Dividing the covariance between two securities by product of the standard deviation of each security gives such a standardised measure.

Year	R _x	Deviation R _x – R _x	R...3 y	Deviation R _y – R _y	Product of deviations (R _x – R _x) (R _y – R _y)
1	10	-4	17	5	-20
2	12	-2	13	1	-2
3	16	2	10	-2	-4
4	18	4	8	-4	-16

This measure is called the coefficient of correlation. This may be expressed as:

$$r_{xy} = \frac{\text{Cov}_{xy}}{\sigma_x \sigma_y}$$

Where

r_{xy} = Coefficient of correlation between x and y.

Cov_{xy} = Covariance between x and y.

σ_x = Standard deviation of x.

σ_y = Standard deviation of y.

It may be noted from the above formula that covariance may be expressed as the product of correlation between the securities and the standard deviation of each of the securities. Thus,

$$\text{Cov}_{xy} = r_{xy}\sigma_x\sigma_y$$

The correlation coefficients may range from - 1 to 1. A value of -1 indicates perfect negative correlation between security returns, while a value of +1 indicates a perfect positive correlation. A value close to zero would indicate that the returns are independent. The variance (or risk) of a portfolio is not simply a weighted average of the variances of the individual securities in the portfolio. The relationship between each security in the portfolio with every other security as measured by the covariance of return has also to be considered. The variance of a portfolio with only two securities in it may be calculated with the following formula.

$$\sigma_p^2 = x_1^2\sigma_1^2 + x_2^2\sigma_2^2 + 2x_1x_2(r_{12}\sigma_1\sigma_2)$$

Where

- σ_p^2 = Portfolio variance.
- x_1 = Proportion of funds invested in the first security.
- x_2 = Proportion of funds invested in the second security.
- σ_1^2 = Variance of first security.
- σ_2^2 = Variance of second security.
- σ_1 = Standard deviation of first security.
- σ_2 = Standard deviation of second security.
- r_{12} = Correlation coefficient between the returns of first and second security.

Portfolio standard deviation can be obtained by taking the square root of

portfolio variance. Let us take an example to understand the calculation of portfolio variance and portfolio standard deviation. Two securities P and Q generate the following sets of expected returns, standard deviations and **correlation coefficient**:

P	Q
$r = 15$ percent	20 percent
$\sigma = 50$ percent	30 percent
$r_{pq} = -0.60$	

A portfolio is constructed with 40 per cent of funds invested in P and the remaining 60 per cent of funds in Q.

The expected return of the portfolio is given by:

$$r_p = \sum_{i=1}^n x_i r_{ij} = (0.40 \times 15) + (0.60 \times 20) = 18$$

The variance of the portfolio is given by:

$$\begin{aligned} \sigma_p^2 &= x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2 + 2x_1 x_2 (r_{12} \sigma_1 \sigma_2) \\ &= (0.40)^2 (50)^2 + (0.60)^2 (30)^2 + 2(0.40)(0.60)(-0.60)(50)(30) \\ &= 400 + 324 - 432 = 292 \end{aligned}$$

The standard deviation of the portfolio is:

$$s_p = \sqrt{292} = 17.09 \text{ per cent.}$$

The return and risk of a portfolio depend on two sets of factors (a) the returns and risks of individual securities and the covariance between securities in the portfolio, (b) the proportion of investment in each security. The first set of factors is parametric to the investor in the sense that he has no control over the returns, risks and covariances of individual securities. The second sets of factors are choice variables in the sense that the investor can choose the proportions of each security

in the portfolio.

Reduction of Portfolio Risk Through Diversification

The process of combining securities in a portfolio is known as diversification. The aim of diversification is to reduce total risk without sacrificing portfolio return. In the example considered above, diversification has helped to reduce risk. The portfolio standard deviation of 17.09 is lower than the standard deviation of either of the two securities taken separately, which were 50 and 30 respectively. To understand the mechanism and power of diversification, it is necessary to consider the impact of covariance or correlation on portfolio risk more closely. We shall examine three cases: (a) when security returns are perfectly positively correlated, (b) when security returns are perfectly negatively correlated, and (c) when security returns are not correlated.

Security Returns Perfectly Positively Correlated

When security returns are perfectly positively correlated the correlation coefficient between the two securities will be +1. The returns of the two securities then move up or down together.

The portfolio variance is calculated using the formula: σ_p^2

$$= x_1^2\sigma_1^2 + x_2^2\sigma_2^2 + 2x_1x_2(r_{12}\sigma_1\sigma_2)$$

Since $r_{12} = 1$, this may be rewritten as:

$$\sigma_p^2 = x_1^2\sigma_1^2 + x_2^2\sigma_2^2 + 2x_1x_2\sigma_1\sigma_2$$

The right hand side of the equation has the same form as the expansion of the identity $(a + b)^2$, namely

$a^2 + 2ab + b^2$. Hence, it may be reduced as

$$\sigma_p^2 = (x_1\sigma_1 + x_2\sigma_2)^2$$

The standard deviation then becomes

$$\sigma_p = x_1\sigma_1 + x_2\sigma_2$$

This is simply the weighted average of the standard deviations of the individual securities.

Taking the same example that we considered earlier for calculating portfolio variance, we shall calculate the portfolio standard deviation when correlation coefficient is +1.

Standard deviation of security P	=	50
Standard deviation of security Q	=	30
Proportion of investment in P	=	0.4
Proportion of investment in Q	=	0.6

Correlation coefficient = +1.0

Portfolio Standard deviation may be calculated as:

$$\begin{aligned}\sigma_p &= x_1\sigma_1 + x_2\sigma_2 \\ &= (0.4)(50) + (0.6)(30) \\ &= 38\end{aligned}$$

Being the weighted average of the standard deviations of individual securities, the portfolio standard deviation will lie between the standard deviations of the two individual securities. In our example, it will vary between 50 and 30 as the proportion of investment in each security changes. For example, if the proportion of investment in P and Q are 0.75 and 0.25 respectively, portfolio standard deviation becomes:

$$\sigma_p = (0.75)(50) + (0.25)(30) = 45$$

Thus, when the security returns are perfectly positively correlated, diversification provides only risk averaging and no risk reduction because the portfolio risk cannot be reduced below the individual security risk. Hence, diversification is not a productive activity when security returns are perfectly positively correlated.

Security Returns Perfectly Negatively Correlated

When security returns are perfectly negatively correlated, the correlation coefficient between them becomes -1. The two returns always move in exactly opposite directions.

$$\begin{aligned} \text{The portfolio variance may be calculated as: } \sigma_p^2 & \\ &= x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2 + \\ & 2x_1 x_2 (r_{12} \sigma_1 \sigma_2) \end{aligned}$$

Since $r_{12} = -1$, this may be rewritten as:

$$\sigma_p^2 = x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2 - 2x_1 x_2 (\sigma_1 \sigma_2)$$

The right-hand side of the equation has the same form as the expansion of the identity $(a - b)^2$, namely $a^2 - 2ab + b^2$. Hence, it may be reduced as:

$$\sigma_p^2 = (x_1 \sigma_1 - x_2 \sigma_2)^2$$

The standard deviation then becomes: $\sigma_p =$

$$|x_1 \sigma_1 - x_2 \sigma_2|$$

For the illustrative portfolio considered above, we can calculate the portfolio standard deviation when the correlation coefficient is -1 .

$$\sigma_p = (0.4)(50) - (0.6)(30) = 2$$

The portfolio risk is very low. It may even be reduced to zero. For example, if the proportion of investment in P and Q are 0.375 and 0.625 respectively, portfolio standard deviation becomes:

$$\sigma_p = (0.375)(50) - (0.625)(30) = 0$$

Here, although the portfolio contains two risky assets, the portfolio has no risk at all. Thus, the portfolio may become entirely risk free when security returns are perfectly negatively correlated. Hence, diversification becomes a highly productive activity when securities are perfectly negatively correlated, because portfolio risk can be considerably reduced and sometimes even eliminated. But, in reality, it is rare to find securities that are perfectly negatively correlated.

Security Returns Uncorrelated

When the returns of two securities are entirely uncorrelated, the correlation coefficient would be zero.

The formula for portfolio variance is:

$$\sigma_p^2 = x_1^2\sigma_1^2 + x_2^2\sigma_2^2 + 2x_1x_2(r_{12}\sigma_1\sigma_2)$$

Since $r_{12} = 0$, the last term in the equation becomes zero; the formula may be rewritten $\sigma_p^2 = x_1^2\sigma_1^2 + x_2^2\sigma_2^2$

$$\sigma_p^2 = x_1^2\sigma_1^2 + x_2^2\sigma_2^2$$

The standard deviation then becomes:

$$\sigma_p = \sqrt{x_1^2\sigma_1^2 + x_2^2\sigma_2^2}$$

For the illustrative portfolio considered above the standard deviation can be calculated when the correlation coefficient is zero.

$$\begin{aligned} \sigma_p &= \sqrt{(0.4)^2(50)^2 + (.6)^2(30)^2} \\ &= \sqrt{400 + 324} \\ &= 26.91 \end{aligned}$$

The portfolio standard deviation is less than the standard deviations of individual securities in the portfolio. Thus, when security returns are uncorrelated, diversification reduces risk and is a productive activity.

We may now tabulate the portfolio standard deviations of our illustrative portfolio having two securities P and Q, for different values of correlation coefficients between them. The proportion of investments in P and Q are 0.4 and 0.6 respectively. The individual standard deviations of P and Q are 50 and 30 respectively.

Portfolio Standard Deviations

Correlation coefficients	Portfolio standard deviations
1.0	38.00
0.6	34.00
0.0	26.91
-0.6	17.09
-1.0	2.00

From the above analysis we may conclude that diversification reduces risk in all cases except when the security returns are perfectly positively correlated. As correlation coefficient declines from +1 to -1, the portfolio standard deviation also declines. But the risk reduction is greater when the security returns are negatively correlated.

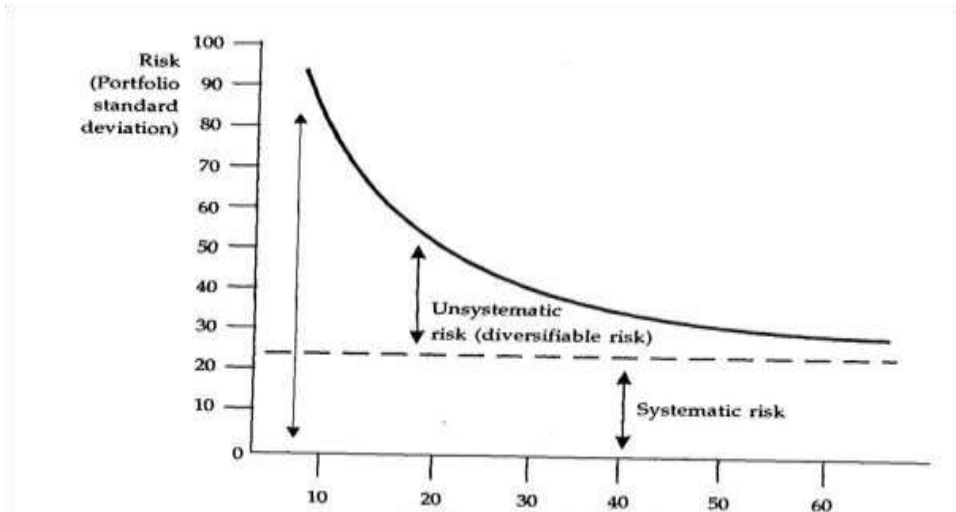
Portfolios With More Than Two Securities

So far, we have considered a portfolio with only two securities. The benefits from diversification increase as more and more securities with less than perfectly positively correlated returns are included in the portfolio. As the number of securities added to a portfolio increases, the

standard deviation of the portfolio becomes smaller and smaller. Hence, an investor can make the portfolio risk arbitrarily small by including a large number of securities with negative or zero correlation in the portfolio. But, in reality, no securities show negative or even zero correlation. Typically, securities show some positive correlation that is above zero but less than the perfectly positive value (+ 1). As a result, diversification (that is, adding securities to a portfolio) results in some reduction in total portfolio risk but not in complete elimination of risk. Moreover, the effects of diversification are exhausted fairly rapidly. That is, most of the reduction in portfolio standard deviation occurs by the time the portfolio size increases to 25 or 30 securities. Adding securities beyond this size brings about only marginal reduction in portfolio standard deviation.

Adding securities to a portfolio reduces risk because securities are not perfectly positively correlated. But the effects of diversification are exhausted rapidly because the securities are still positively correlated to each other though not perfectly correlated. Had they been negatively correlated, the portfolio risk would have continued to decline as portfolio size increased. Thus, in practice, the benefits of diversification are limited. The total risk of an individual security comprises two components, the market related risk called systematic risk and the unique risk of that particular security called unsystematic risk. By combining securities into a portfolio the unsystematic risk specific to different securities is cancelled out. Consequently, the risk of the portfolio as a whole is reduced as the size of the portfolio increases. Ultimately when the size of the portfolio reaches a certain limit, it will contain only the systematic risk of securities included in the portfolio. The systematic risk, however, cannot be eliminated. Thus, a fairly large portfolio has only systematic risk and has relatively little unsystematic risk. That is why there is no gain in adding securities to a portfolio beyond a certain portfolio size. Figure depicts the diversification of risk in a portfolio.

Diversification of risk



The figure shows the portfolio risk declining as the number of securities in the portfolio increases, but the risk reduction ceases when the unsystematic risk is eliminated.

Risk-Return Calculations of Portfolios with More Than Two Securities

The expected return of a portfolio is the weighted average of the returns of individual securities in the portfolio, the weights being the proportion of investment in each security. The formula for calculation of expected portfolio return is the same for a portfolio with two securities and for portfolios with more than two securities. The formula is:

$$r_P = \sum_{i=1}^n x_i r_i$$

Where:

r_p = Expected return of portfolio.

x_i = Proportion of funds

invested in each security.

r_i = Expected return of each
security.

n = Number of securities in the portfolio.

Let us consider a portfolio with four securities having the following characteristics

Security Returns (per cent)	Proportion of investment	
A	12	0.2
B	17	0.3
C	23	0.1
D	20	0.4

The expected return of this portfolio may be calculated using the formula:

$$r_p = \sum_{i=1}^n X_i r_i$$

$$\begin{aligned} r_p &= (0.2)(12) + (0.3)(17) + (0.1)(23) + (0.4)(20) \\ &= 17.8 \text{ per cent} \end{aligned}$$

The portfolio variance and standard deviation depend on the proportion of investment in each security, as also the variance and covariance of each security included in the portfolio.

The formula for portfolio variance of a portfolio with more than two securities

is as follows:
$$\sigma_p^2 = \sum_{i=1}^n \sum_{j=1}^n x_i x_j \sigma_{ij}$$

Where:

σ_p^2 = Portfolio variance.

x_i = Proportion of funds invested in security i (the first of a pair of securities)

x_j = Proportion of funds invested in security j (the second of a pair of securities)

σ_{ij} = The covariance between the pair of securities i and j.

n = Total number of securities in the portfolio.

The double summation

$$\sum_{i=1}^n \sum_{j=1}^n$$

indicates that n^2 numbers of values are to be summed up. These values are obtained by substituting the values of x_i , x_j and σ_{ij} for each possible pair of securities.

The method of calculation can be illustrated through an example.

A convenient way to obtain the result is to set up the data required for calculation in the form of a variance-covariance matrix. Let us consider a portfolio with three securities A, B and C. The proportions of investment in each of these securities are 0.20, 0.30 and 0.50 respectively. The variance of each security and the covariance of each

possible pair of securities may be set up as a matrix as follows:

Variance-Covariance Matrix

Weight ↓	→	0.2	0.3	0.5
		A	B	C
0.2	A	52	63	36
0.3	B	63	39	74
0.5	C	36	74	45

The entries along the diagonal of the matrix represent the variances of securities A, B and C. The other entries in the matrix represent the covariance of the respective pairs of securities such as A and B, A and C, B and C. Once the variance-covariance matrix is set up, the computation of portfolio variance is a comparatively simple operation. Each cell in the matrix represents a pair of two securities. For example, the first cell in the first row of the matrix represents A and A; the second cell in the first row represents securities A and B, and so on. The variance or covariance in each cell has to be multiplied by the weights of the respective securities represented by that cell. These weights are available in the matrix at the left side of the row and the top of the column containing the cell. This process may be started from the first cell in the first row and continued for all the cells till the last cell of the last row is reached. When all these products are summed up, the resulting figure is the portfolio variance. The square root of this figure gives the portfolio standard deviation.

The variance of the illustrative portfolio given above can now

be calculated. $\sigma_P^2 =$

$$\begin{aligned}
 & (0.2 \times 0.2 \times 52) + (0.2 \times 0.3 \times 63) + (0.2 \times 0.5 \times 36) \\
 & + (0.3 \times 0.2 \times 63) + (0.3 \times 0.3 \times 39) + (0.3 \times 0.5 \times 74) \\
 & + (0.5 \times 0.2 \times 36) + (0.5 \times 0.3 \times 74) + (0.5 \times 0.5 \times 45) \\
 & = 53.71.
 \end{aligned}$$

The portfolio

standard
 deviation
 is: σ_p
 =
 $\sqrt{53.71}$
 =
 7.3287

We have seen earlier that covariance between two securities may be expressed as the

product of correlation coefficient between the two securities and standard deviations of the two securities.

Thus,

$$\sigma_{ij} = r_{ij} \sigma_i \sigma_j$$

Where

σ_{ij} = Covariance between security i and security j.

r_{ij} = Correlation coefficient between security i and security j.

σ_i = Standard deviation of security i.

σ_j = Standard deviation of security j.

Hence, the formula for computing portfolio variance may also be stated in the following form:

$$\sigma_p^2 = \sum_{i=1}^n \sum_{j=1}^n x_i x_j r_{ij} \sigma_i \sigma_j$$

To illustrate the use of this formula let us calculate the portfolio variance

and standard deviation for a portfolio with the following characteristics.

Security	x_i	σ_i	Correlation coefficients
P	0.35	7	P and Q = 0.7
Q	0.25	16	P and R = 0.3
R	0.40	9	Q and R = 0.4

It may be noted that correlation coefficient between P and P, Q and Q, R and R is 1.

The variance-covariance matrix may be set up as follows:

Weight ↓		0.35 → P	0.25 Q	0.40 R
0.35 P		$1 \times 7 \times 7$	$0.7 \times 7 \times 16$	$0.3 \times 7 \times 9$
0.25 Q		$0.7 \times 16 \times 7$	$1 \times 16 \times 16$	$0.4 \times 16 \times 9$
0.40 R		$0.3 \times 9 \times 7$	$0.4 \times 9 \times 16$	$1 \times 9 \times 9$

The portfolio variance can now be calculated using this variance-covariance matrix as shown below:

$$\begin{aligned}
 \sigma_p^2 &= (0.35 \times 0.35 \times 1 \times 7 \times 7) + (0.35 \times 0.25 \times 0.7 \times 7 \times 16) \\
 &\quad + (0.35 \times 0.40 \times 0.3 \times 7 \times 9) + (0.25 \times 0.35 \times 0.7 \times 16 \times 7) \\
 &\quad + (0.25 \times 0.25 \times 1 \times 16 \times 16) + (0.25 \times 0.40 \times 0.4 \times 16 \times 9) \\
 &\quad + (0.40 \times 0.35 \times 0.3 \times 9 \times 7) + (0.40 \times 0.25 \times 0.4 \times 9 \times 16) \\
 &\quad + (0.40 \times 0.40 \times 1 \times 9 \times 9) \\
 &= 65.4945
 \end{aligned}$$

The portfolio standard deviation is: $\sigma_p = \sqrt{65.4945} = 8.09$

A portfolio is a combination of assets. From a given set of n securities, any number of portfolios can be created. The portfolios may comprise of two securities, three securities, all the way up to 'n' securities. A portfolio may contain the same securities as another portfolio but with different weights. Thus, new portfolios can be created either by changing the securities in the portfolio or by changing the proportion of investment in the existing securities. Each portfolio is characterized by its expected return and risk. Determining the expected return and risk (variance or standard deviation) of each portfolio that can be created from a set of selected securities is the first step in portfolio management and is called portfolio analysis.

Quantitative Methods of Investment Analysis

Time Value of Money (TVM) is a core concept in finance that states a sum of money is worth more now than the same sum will be at a future date. This is due to its potential earning capacity. The fundamental principle of TVM is that money can grow over time through interest, which is the cost of borrowing money. TVM calculations are used to compare cash flows at different points in time.

$$FV = PV \cdot (1+r)^n$$

Where:

- FV is the future value of the money
- PV is the present value of the money
- r is the annual interest rate
- n is the number of periods (usually years)

Problem: You invest \$1,000 in an account that earns a 5% annual return. What will your investment be worth in 10 years?

Where:

- x_i is each data point (each return)
- μ is the population mean (the average return)
- N is the number of data points

Problem: A stock had annual returns of 10%, 15%, and 5% over three years. Calculate the variance and standard deviation of its returns.

Solution:

1. Calculate the average return (μ):

$$\mu = (0.10 + 0.15 + 0.05) / 3 = 0.30 / 3 = 0.10 \text{ or } 10\%$$

2. Calculate the variance:

$$\sigma^2 = [(0.10 - 0.10)^2 + (0.15 - 0.10)^2 + (0.05 - 0.10)^2] / 3$$

$$\sigma^2 = [0 + 0.0025 + 0.0025] / 3 = 0.005 / 3 = 0.001667$$

3. Calculate the standard deviation:

$$\sigma = \sqrt{0.001667} \approx 0.0408 \text{ or } 4.08\%$$

Beta (β)

Beta is a measure of a stock's volatility in relation to the overall market. It is a key component of the Capital Asset Pricing Model (CAPM). A beta of 1 means the stock's price will move with the market. A beta greater than 1 means the stock is more volatile than the market, and a beta less than 1 means it is less volatile.

Beta (β) formula:

$$\beta = \frac{\text{Covariance}(R_a, R_b)}{\text{Variance}(R_b)}$$

Where:

- R_a is the return of the asset
- R_b is the return of the market benchmark

Correlation and Covariance

These two statistical measures describe the relationship between two variables.

Covariance measures the directional relationship between the returns of two assets. A positive covariance means the returns move together, while a negative covariance means they move in opposite directions.

$$Cov(X, Y) = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_i - \bar{Y})}{n - 1}$$

Correlation is a standardized version of covariance, scaled to be between -1 and +1.

- **+1:** Perfect positive correlation (move perfectly together)
- **-1:** Perfect negative correlation (move perfectly opposite)
- **0:** No correlation (no linear relationship)

Correlation (ρ) formula:

$$\rho_{XY} = \frac{Cov(X, Y)}{\sigma_X \sigma_Y}$$

Problem: Calculate the covariance and correlation between Stock A and Stock B using the following returns:

Stock A: 5%, 8%, 6%

Stock B: 10%, 12%, 8%

Solution:

1. **Calculate average returns:**

$$A^- = (0.05 + 0.08 + 0.06) / 3 = 0.0633$$

$$\bar{B} = (0.10 + 0.12 + 0.08) / 3 = 0.10$$

2. **Calculate Covariance:** $\text{Cov}(A, B) = [(0.05 - 0.0633)(0.10 - 0.10) + (0.08 - 0.0633)(0.12 - 0.10) + (0.06 - 0.0633)(0.08 - 0.10)] / (3 - 1)$

$$\text{Cov}(A, B) = [(-0.0133)(0) + (0.0167)(0.02) + (-0.0033)(-0.02)] / 2$$

$$\text{Cov}(A, B) = [0 + 0.000334 + 0.000066] / 2 = 0.0004 / 2 = 0.0002$$

2. **Calculate Standard Deviations:** (using sample formula)

$$\sigma_A = \sqrt{[(0.05 - 0.0633)^2 + (0.08 - 0.0633)^2 + (0.06 - 0.0633)^2] / 2} = \sqrt{0.000267 / 2} = \sqrt{0.0001335} \approx 0.01155$$

$$\sigma_B = \sqrt{[(0.10 - 0.10)^2 + (0.12 - 0.10)^2 + (0.08 - 0.10)^2] / 2} = \sqrt{[0 + 0.0004 + 0.0004] / 2} = \sqrt{0.0004} = 0.02$$

3. **Calculate Correlation:**

$$\rho_{AB} = 0.0002 / (0.01155 * 0.02) = 0.0002 / 0.000231 \approx 0.8658$$

A correlation of **0.8658** indicates a strong positive relationship between the returns of the two stocks.

Regression Analysis in Finance

Regression analysis is a powerful statistical tool used to estimate the relationship between a dependent variable and one or more independent variables. In finance, it is often used to predict asset prices, analyze risk, and determine the relationship between a stock's returns and the overall market's returns. This is precisely how **beta** is calculated.

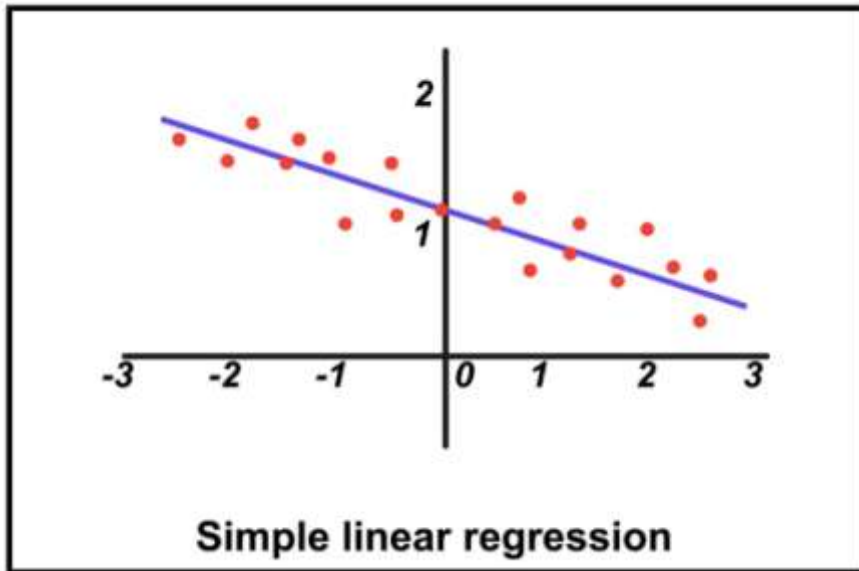
The **simple linear regression** model is represented by the equation:

$$Y_i = \alpha + \beta X_i + \epsilon_i$$

Where:

- Y_i is the dependent variable (e.g., stock return)
- X_i is the independent variable (e.g., market return)

- α (alpha) is the Y-intercept, representing the asset's return when the market return is zero.
- β (beta) is the slope, representing the sensitivity of the asset's return to the market's return.
- ϵ_i is the error term.



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Problem: A stock's returns (Y) and the market's returns (X) are given. Use regression to find the stock's beta.

Solution: This typically involves software like Excel or Python, which will calculate the regression coefficients (α and β). The resulting beta value shows the stock's risk relative to the market.

Utility Theory and Investor Preferences

Utility theory in finance suggests that investors make decisions based on maximizing their **expected utility** rather than just maximizing their expected return. Utility is a measure of satisfaction or happiness.

- **Risk-averse:** An investor who prefers a certain outcome over a risky one with the same expected return. They require a higher expected return to take on more risk.
- **Risk-neutral:** An investor who is indifferent between a certain outcome and a risky one with the same expected return.
- **Risk-seeking:** An investor who prefers a risky outcome over a certain one with the same expected return.

Investor preferences are often visualized with **indifference curves**, which show combinations of risk (standard deviation) and return that give an investor the same level of utility. An investor will choose the portfolio that lies on the highest possible indifference curve, given the available investment opportunities.

Problem: An investor is offered two portfolios:

- Portfolio A: Expected return of 10% with a standard deviation of 5%.
- Portfolio B: Expected return of 12% with a standard deviation of 8%. A risk-averse investor would choose Portfolio A, even though B has a higher return, because the increase in return is not enough to compensate for the higher risk. A risk-seeking investor might choose Portfolio B because they are willing to accept the higher risk for the chance of a higher return.

Capital Allocation to Risky Assets

This chapter explores the fundamental concepts of allocating capital between risk-free and risky assets. We'll delve into how investors make decisions based on their risk tolerance and return expectations, culminating in the construction of an optimal portfolio.

Risk-Free Asset vs. Risky Asset:

At the heart of capital allocation lies the distinction between risk-free and risky assets.

A **risk-free asset** is an investment that offers a certain return with no possibility of loss. While no asset is truly 100% risk-free in the real world (due to inflation risk, reinvestment risk, etc.), for practical purposes in finance, we often consider short-term government securities, like Treasury bills, as proxies for risk-free assets. Their returns are known with virtual certainty over their short maturity period.

In contrast, a **risky asset** is any investment whose future return is uncertain. This uncertainty introduces the possibility of both higher returns and potential losses. Examples include stocks, corporate bonds, real estate, and commodities. Investors demand a higher expected return from risky assets to compensate them for bearing this uncertainty. The greater the uncertainty, the higher the risk, and consequently, the higher the expected return an investor would require.

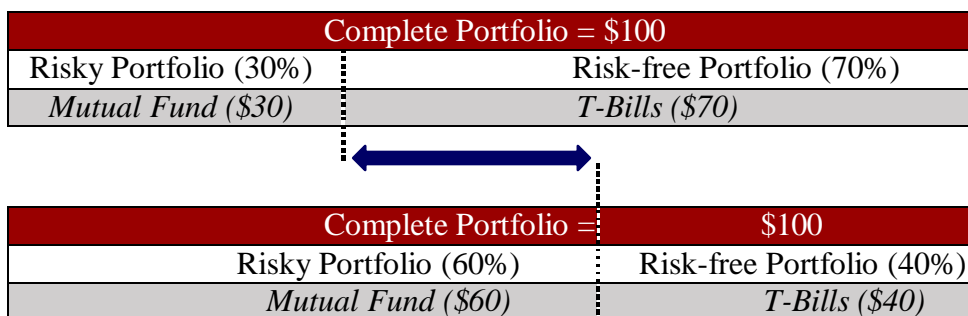
The decision to allocate capital between these two types of assets depends heavily on an investor's individual risk tolerance and investment goals.

Capital Allocation :

The relationship between risk and reward is at the heart of modern investment decisions, and one of the most powerful ways to manage this trade-off is through the allocation of capital between a risky portfolio and a risk-free asset. A risky portfolio, such as a mutual fund comprising stocks, corporate bonds, or other market-traded securities, promises higher expected returns but comes with greater volatility and uncertainty. In contrast, a risk-free asset, typically represented by government-issued Treasury Bills, ensures safety and stability, though with relatively lower returns. By strategically deciding how much capital to allocate to each, investors can tailor their overall risk-return profile to match their unique preferences and tolerance for risk. Allocating a larger share to the risky portfolio amplifies both the potential gains and the potential losses, while increasing the weight on the risk-free asset cushions the portfolio against volatility but limits opportunities for growth. This balance between risk-free and risky investments can be visualized through the Capital Allocation Line (CAL), which illustrates all possible combinations of risk and return available to the investor. The slope of the CAL represents the trade-off between additional risk and the expected excess return, and the investor's optimal choice depends on the shape of their indifference curves, which capture their personal attitude toward risk. Thus, capital

allocation is not merely a technical exercise but a reflection of the investor’s psychology, goals, and financial circumstances, forming the foundation of modern portfolio construction.

Figure 1: The Complete Portfolio



The central decision in capital allocation lies in determining how much of one’s wealth to invest in the risky portfolio versus the risk-free asset, a choice that depends directly on the investor’s level of risk tolerance. The expected return of the complete portfolio, denoted as $E(r_c)$, is simply the weighted average of the expected return on the risky portfolio, $E(r_p)$, and the return on the risk-free asset, r_f . If the investor allocates a proportion y of their wealth to the risky portfolio (and the remaining $1-y$ to the risk-free asset), the expected return of the complete portfolio is given by:

$$E(r_c) = yE(r_p) + (1-y)r_f$$

This expression shows that the overall expected return depends not only on the performance of the risky portfolio but also on the weight assigned to it. On the risk side, the standard deviation of the complete portfolio, σ_c , is equal to the standard deviation of the risky portfolio, σ_p , scaled by its weight y :

$$\sigma_c = y\sigma_p$$

Thus, as the investor increases the proportion of wealth invested in the risky portfolio, both the expected return and the level of risk in the complete portfolio rise proportionally, while shifting more capital toward the risk-free asset reduces volatility but limits return.

PRACTICE: What is the (a) expected return, (b) standard deviation, (c) risk premium, and (d) Sharpe ratio for a complete portfolio given the yield on 90-day T-Bills is 3.7%, the expected return of a risky fund is 11.93%, its standard deviation is 20%, and you choose to hold 75% of your investing dollars in the risky portfolio?

SOLUTION: The expected return (a) of the complete portfolio is the weighted average of the returns to the risky portfolio and risk-free asset:

$$E(r_c) = yE(r_p) + (1 - y)r_f$$

The standard deviation of the complete portfolio (b) is:

$$\sigma_c = y\sigma_p$$

Recalling the definition of risk premium as the expected return in excess of the return on risk-free securities, (c) must be:

$$E(r_c) - r_f =$$

And we use this risk premium for the Sharpe Ratio computation (d):

$$S = \frac{E(r_c) - r_f}{\sigma_c} = \frac{\text{Risk Premium}}{\sigma_c} =$$

Note that we now subscript the expected return and standard deviation with C since we are computing this ratio for the complete portfolio.

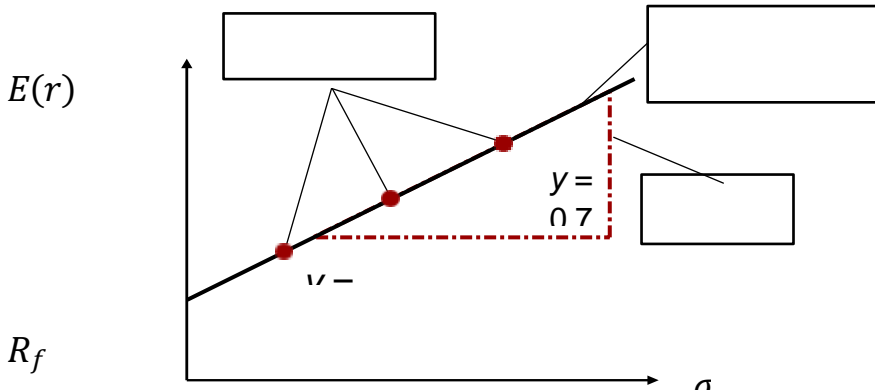
INTERPRETATION: The complete portfolio's risk and return profile is affected by the weights we put in the risky asset. Increasing weight to the risky portfolio increases the return, but it also increases the risk. But what happens to the Sharpe ratio as we increase the weight 'y' in the risky asset?

The Capital Allocation Line:

The complete portfolio can have varying risk-return profiles by changing the weight y in the risky asset. We can plot this on a coordinate plane, with the expected return on the vertical axis, and the risk on the horizontal axis. Each point tells us the return and risk of a portfolio that consists of the risky asset and the risk-free asset. As we adjust the weight y, the return and risk profile changes linearly. All complete portfolios will fall on one line, with the Sharpe ratio

representing the slope of that line.²

Figure 2: The Capital Allocation Line



The set of complete portfolios obtained by varying y forms a straight line when plotted in risk–return space. This line is known as the **Capital Allocation Line (CAL)**. The CAL intersects the vertical axis at the risk-free rate of return, which corresponds to a standard deviation of zero.

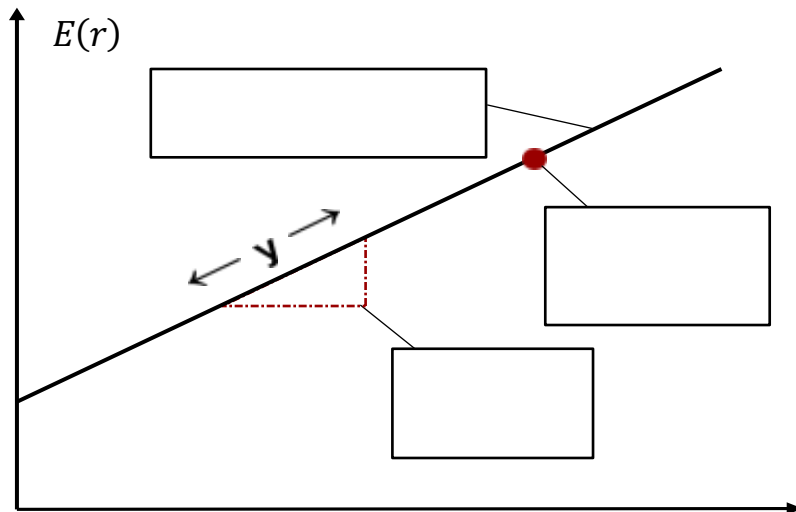
The Capital Market Line & The Passive Strategy:

The CAL consists of some weight y in a risky portfolio and $1-y$ in the risk-free asset. This risky portfolio can be an actively managed or passively managed mutual fund. It might be a portfolio of stocks, bonds, or other assets that an investor constructs themselves.

The Capital Market Line:

In the context of the Capital Allocation Line (CAL), the risky portfolio is often assumed to be the market portfolio, which is then combined with the risk-free asset to construct an investor’s complete portfolio. The market portfolio is a theoretical, value-weighted portfolio that contains every possible asset in the economy—publicly traded securities such as stocks and bonds, as well as non-traded assets like currencies, real estate, commodities, collectibles, and even fine art or automobiles. Since it is impossible to hold every asset in existence, the true market portfolio cannot be directly observed or constructed in practice. As a result, investors typically rely on a broad-based index fund—such as the S&P 500 or a global market index—as a practical proxy for the theoretical market portfolio

Figure 3: The Capital Market Line



The Passive Strategy:

Pursuing a passive strategy entail allocating capital between the risk-free asset and the market portfolio rather than individually selecting how to construct the risky portfolio. As we've seen above, any choice of y is as good as any other and should be chosen based on the investor's risk tolerance. The passive strategy is a reasonable strategy due to (1) the cost of active investing – or the time and money spent doing research and/or the fees paid to professional managers and (2) the free rider benefit – “free ride” off the active participants in markets who establish efficiency through their buying and selling activities.

Critical Thinking Questions:

1. What is the “capital allocation” decision?
2. Explain how T-bills are risk-free if they have a historical standard deviation.
3. A friend tells you “I have 90% of my money in the QQQ index fund, and the rest in cash. You only have 60% of your money in the QQQ index fund and the rest in cash. Clearly my expected return is higher, and my portfolio is superior to

yours.” Critique this claim.

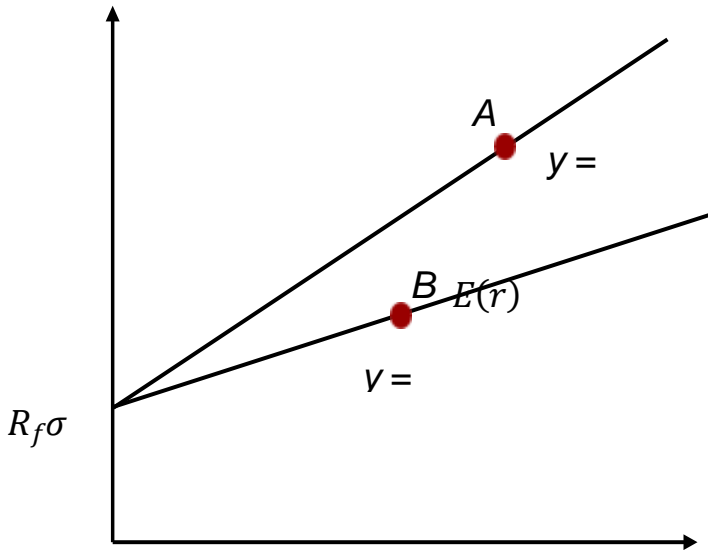
4. What determines how much an investor invests in the risky and risk-free portfolios?
5. How many different portfolios are there in the investment opportunity set that the CAL graphically depicts?
6. How do we obtain the expected return and standard deviation of the risky portfolio that is needed to compute the expected return and standard deviation of the complete portfolio?
7. What type of assets comprise a portfolio on the CAL?
8. What might we use as the “risky asset”?
9. Is there a “best” portfolio to hold on the CAL?
10. Can you draw and label the CAL?
11. Can you draw and label the CML?
12. What is the slope of the CAL? What is the slope of the CML?
13. Can you derive the slope of the CAL given the coordinates (x_2, y_2) for the complete portfolio and the coordinates (x_1, y_1) for the risk-free rate? (Hint: see the “Notes and References” below)
14. What can cause the CAL’s slope to increase? (Hint: use the CAL Excel File)
15. What can cause the intercept of the CAL to shift upward? (Hint: use the CAL Excel File)
16. What can “stretch” the CAL in the x-direction? (Hint: use the CAL Excel File)
17. What is the y-intercept of the CAL?
18. What could we use to proxy for the market portfolio on the CML, and why do we need to “proxy” for the market

portfolio?

19. If we only know the expected return of the risky portfolio, the standard deviation of the risky portfolio, and the risk-free rate of return, can we find the Sharpe ratio of the complete portfolio without knowing the weight we put in the risk-free asset?
20. How can two investors have two different CALs?
21. Why do all investors have the same CML?
22. A friend tells you “I have 90% of my money in the Q index fund with an expected return of 22%, and the rest in cash. You have 90% of your money in the SPX index fund with an expected return of 14% and the rest in cash. Clearly my portfolio is superior to yours.” Critique this claim.
23. CHALLENGE An investor holds some of their money in the Fidelity Small Cap Growth Fund and some of their money in T-bills. Another investor holds some of their money in the Vanguard Large Cap Value Fund and some in T-bills. Do they have the same Sharpe ratio? Can they have the same Sharpe ratio? Do these investors lie on the same CAL? Can one of these investors have a better “complete” portfolio than the other just by changing the weights they invest in their risky portfolio?

Analytical Questions

1. Use the diagram of the CALs below to answer the questions that follow. The portfolio labeled A consists of an allocation between the risk-free asset and a stock portfolio. The portfolio labeled B consists of an allocation between the risk-free asset and a bond portfolio. Warren holds the stock portfolio with $y = 0.75$ and Charlie holds the bond portfolio with $y = 0.25$.



- What can Warren do if he wants to lower his risk below that of Charlie?
- Is it possible for Charlie to increase his return beyond that of Warren?
- Can we conclude that one of these portfolios is better than the other?
- If Warren lowers his y to 0.10 and Charlie raises his y to 0.9, who will have the higher Sharpe

Optimal Risky Portfolios

In the context of the Capital Allocation Line (CAL), the risky portfolio is often assumed to be the market portfolio, which is then combined with the risk-free asset to construct an investor's complete portfolio. The market portfolio is a theoretical, value-weighted portfolio that contains every possible asset in the economy—publicly traded securities such as stocks and bonds, as well as non-traded assets like currencies, real estate, commodities, collectibles, and even fine art or automobiles. Since it is impossible to hold every asset in existence, the true market portfolio cannot be directly observed or constructed in practice. As a result, investors typically rely on a broad-based index fund—such as the S&P 500 or a global market index—as a practical proxy for the theoretical market portfolio.

4.1 Constructing a risky portfolio

Returns & weights

For n risky assets with expected returns $\mu = (E[R_1], \dots, E[R_n])^\top$ and weights $w = (w_1, \dots, w_n)^\top$

(with $\sum_i w_i = 1$),

$$E[R_p] \equiv \mu_p = w^\top \mu.$$

Risk (variance) and diversification

Let Σ be the covariance matrix with $\Sigma_{ij} = \text{Cov}(R_i, R_j)$. Portfolio variance is

$$\sigma_p^2 = w^\top \Sigma w.$$

For two assets 1, 2 with volatilities σ_1, σ_2 and correlation ρ ,

$$\sigma_p^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \rho \sigma_1 \sigma_2, \quad w_2 = 1 - w_1.$$

Covariance (or correlation) determines the diversification benefit. Lower (especially negative) correlation σ_p for given μ_p

4.2 Feasible set and efficient frontier:

- Feasible set (opportunity set): all attainable (σ_p, μ_p) pairs by varying w (with or without constraints like no short-selling).
- Efficient frontier (risky assets only): the upper envelope of the feasible set—portfolios that minimize variance for each expected return (equivalently, maximize expected return for each variance).

Closed-form frontier (unconstrained):

Let

$$A = \mathbf{1}^\top \Sigma^{-1} \mathbf{1}, \quad B = \mathbf{1}^\top \Sigma^{-1} \mu, \quad C = \mu^\top \Sigma^{-1} \mu, \quad D = AC - B^2.$$

Then the frontier satisfies

$$\sigma^2(\mu_p) = \frac{A\mu_p^2 - 2B\mu_p + C}{D}, \quad (\text{with } D > 0).$$

The **global minimum-variance (GMV)** portfolio is

$$w_{\text{GMV}} = \frac{\Sigma^{-1}\mathbf{1}}{\mathbf{1}^\top \Sigma^{-1}\mathbf{1}}, \quad \mu_{\text{GMV}} = \frac{B}{A}, \quad \sigma_{\text{GMV}}^2 = \frac{1}{A}.$$

4.3 Sharpe ratio and the tangency (optimal risky) portfolio

For risk-free rate R_f , the Sharpe ratio of portfolio p is

$$S_p = \frac{\mu_p - R_f}{\sigma_p}.$$

The tangency portfolio w_T (also called the maximum Sharpe or optimal risky portfolio) solves

$$\max_{w: \mathbf{1}^\top w = 1} \frac{w^\top \mu - R_f}{\sqrt{w^\top \Sigma w}} \iff w_T = \frac{\Sigma^{-1}(\mu - R_f \mathbf{1})}{\mathbf{1}^\top \Sigma^{-1}(\mu - R_f \mathbf{1})}.$$

Its point (σ_T, μ_T) is where the CAL is tangent to the risky-asset frontier.

4.4 Separation theorem (Tobin)

Two-fund separation:

An important result in modern portfolio theory is **Tobin's Separation Theorem** (also known as the **two-fund separation theorem**). It states that the investment decision can be separated into two independent tasks:

1. Determining the optimal risky portfolio:

- All investors, regardless of their individual risk preferences, will identify the same optimal portfolio of risky assets.
- This portfolio maximizes the Sharpe ratio and lies at the tangent point between the efficient frontier of risky assets and the capital allocation line (CAL).

2. Choosing the mix between the risk-free asset and the optimal risky portfolio:

- Depending on their risk tolerance, investors will adjust their position along the CAL.
- Conservative investors will allocate more to the risk-free asset, while aggressive investors may even borrow at the risk-free rate to leverage their position in the risky portfolio.

Implications

The theorem implies that portfolio construction is **universal in the risky space**:

- A pension fund manager, a retail investor, and a hedge fund manager will all hold the same optimal risky portfolio if they share the same input assumptions.
- Their differences emerge only in how much they allocate between that risky portfolio and the risk-free asset.

This elegant result greatly simplifies the portfolio selection problem, turning a complex multidimensional optimization into a two-step process.

Two-fund separation:

All investors hold the same tangency portfolio w_T of risky assets (given the same inputs μ, Σ, R_f).

They differ only in how much of that risky fund they mix with the risk-free asset. If y is the share in the tangency portfolio

(and $1 - y$ in R_f), then

$$E[R_C] = R_f + y(\mu_T - R_f), \quad \sigma_C = y\sigma_T.$$

Conservative investors: $0 < y < 1$.

- Aggressive investors: $y > 1$ (borrow at/above R_f to lever).
- If borrowing and lending rates differ, the CAL has a kink at the tangency point.

Example 1 — Two-asset minimum-variance portfolio

Assets:

- $E[R_X] = 8\%$, $\sigma_X = 15\%$
- $E[R_Y] = 12\%$, $\sigma_Y = 20\%$
- $\rho_{XY} = 0.30$ (so $\text{Cov}_{XY} = 0.3 \times 0.15 \times 0.20 = 0.009$)

MVP weight on X :

$$w_X^* = \frac{\sigma_Y^2 - \text{Cov}_{XY}}{\sigma_X^2 + \sigma_Y^2 - 2\text{Cov}_{XY}} = \frac{0.04 - 0.009}{0.0225 + 0.04 - 2 \times 0.009} \approx 0.697.$$

So $w_Y^* \approx 0.303$.

- $E[R_{\text{MVP}}] \approx 0.697(0.08) + 0.303(0.12) \approx 9.21\%$.
- $\sigma_{\text{MVP}} \approx 13.57\%$.

Interpretation: Even though Y has the higher mean, the MVP tilts toward X because of its lower variance and the modest correlation.

Example 2 — Correlation changes diversification:

Same as Example 1 but $\rho_{XY} = -0.50$.

Compute $\text{Cov}_{XY} = -0.5 \times 0.15 \times 0.20 = -0.015$. Then

$$w_X^* = \frac{0.04 - (-0.015)}{0.0225 + 0.04 - 2(-0.015)} = \frac{0.055}{0.0925} \approx 0.595, \quad w_Y^* \approx 0.405.$$

- $E[R_{\text{MVP}}] \approx 9.62\%$.
- $\sigma_{\text{MVP}} \approx 8.54\%$.

Insight: Negative correlation dramatically lowers risk for similar expected return—this is the core of diversification.

Example 3 — **Tangency** portfolio (max Sharpe) with a risk-free asset

Use Example 1's assets, $R_f = 3\%$.

$$w_T = \frac{\Sigma^{-1}(\mu - R_f \mathbf{1})}{\mathbf{1}^\top \Sigma^{-1}(\mu - R_f \mathbf{1})} \Rightarrow w_T \approx (0.4304 \text{ in } X, 0.5696 \text{ in } Y).$$

- $\mu_T \approx 10.278\%$, $\sigma_T \approx 14.683\%$.
- Sharpe $\approx (\mu_T - R_f)/\sigma_T \approx 0.496$.

Why not the MVP? MVP minimizes risk; tangency maximizes risk-adjusted return.

Example 4 — Personalizing risk with the CAL (Separation Theorem)

Using Example 3 results:

- Target $\sigma_C = 10\%$. Then $y = \sigma_C/\sigma_T \approx 0.681$.
 $\Rightarrow E[R_C] = 0.03 + 0.681(0.10278 - 0.03) \approx 7.96\%$.
- Target $\sigma_C = 20\%$ (levered): $y \approx 1.362$.
 $\Rightarrow E[R_C] \approx 12.91\%$. The investor borrows 36.2% of wealth to lever w_T .

If borrowing rate is higher, say $R_f^{\text{borrow}} = 5\%$, then for $y > 1$ the slope beyond tangency is lower, and the 20% target yields $\approx 12.19\%$ instead of 12.91% (kinked CAL).

Example 5 — Three-asset GMV and Tangency

Suppose

$$\mu = \begin{bmatrix} 8\% \\ 11\% \\ 14\% \end{bmatrix}, \quad \sigma = \begin{bmatrix} 15\% \\ 18\% \\ 25\% \end{bmatrix}, \quad \rho = \begin{bmatrix} 1 & 0.2 & 0.1 \\ 0.2 & 1 & 0.3 \\ 0.1 & 0.3 & 1 \end{bmatrix}, \quad R_f = 3\%.$$

Then $\Sigma = \text{diag}(\sigma) \rho \text{diag}(\sigma)$.

- **GMV:** $w_{\text{GMV}} \approx (0.559, 0.305, 0.136)$.
 $\mu_{\text{GMV}} \approx 9.73\%$, $\sigma_{\text{GMV}} \approx 12.14\%$.
- **Tangency:** $w_T \approx (0.352, 0.363, 0.286)$.
 $\mu_T \approx 10.80\%$, $\sigma_T \approx 13.07\%$, $S \approx 0.597$.

Frontier constants (optional):

$$A \approx 67.878, \quad B \approx 6.606, \quad C \approx 0.692, \quad D = AC - B^2 \approx 3.319.$$

$$\text{Then for any target } \mu_p, \quad \sigma^2(\mu_p) = \frac{A\mu_p^2 - 2B\mu_p + C}{D}.$$

Example: for $\mu_p = 11\%$, $\sigma \approx 13.42\%$.

Example 6 — Estimating inputs from data (and a short-sale edge case)

Monthly returns (decimal) for 6 months:

Month	Asset A	Asset B
1	0.020	0.010
2	-0.010	0.000
3	0.030	0.020
4	0.000	-0.010
5	0.020	0.010
6	0.040	0.030

- S
- $\bar{r}_A = 1.667\%$, $\bar{r}_B = 1.000\%$.
 - $\sigma_A \approx 1.862\%$, $\sigma_B \approx 1.414\%$.
 - $\text{Cov}_{AB} \approx 0.00024$, $\rho \approx 0.911$.

Unconstrained MVP (allowing shorts) gives $w_A^* = -0.60$, $w_B^* = 1.60$ (i.e., short A 60%, long B 160%).

With a no-short-selling constraint, the optimum hits the boundary: $w_A = 0$, $w_B = 1$.

Summary:

1. Estimation error: Sample means are noisy; shrinkage or Bayesian/robust estimators for μ , Σ are common.
2. Turnover & costs: High-frequency rebalancing to target frontier points can erode gains.
3. Constraints: No-shorts, sector caps, leverage limits reshape the feasible set and the optimal portfolio.

4. Different borrowing/lending rates: Kinked CAL; “optimal risky” for borrowing can differ from lending case.

Problem 1 (two-asset MVP)

$$E[R_1]=7\%, \sigma_1=10\%; E[R_2]=11\%, \sigma_2=18\%; \rho=0.25$$

(a) Find MVP weights. (b) μ_{MVP} and σ_{MVP} .

Solution. $Cov=0.25 \times 0.10 \times 0.18=0.0045$

$$w_1^* = \frac{0.18^2 - 0.0045}{0.10^2 + 0.18^2 - 2(0.0045)} = \frac{0.0324 - 0.0045}{0.01 + 0.0324 - 0.009} = \frac{0.0279}{0.0334} \approx 0.835.$$

So $w_2^* \approx 0.165$.

$$\mu_{MVP} \approx 0.835(0.07) + 0.165(0.11) = 7.66\%.$$

$$\sigma_{MVP} = \sqrt{w^T \Sigma w} \approx 9.36\%.$$

Problem 2 (impact of correlation)

Use Problem 1 but $\rho=-0.4$. Recompute σ_{MVP} .

$$Cov=-0.4 \times 0.10 \times 0.18=-0.0072.$$

Solution.

$$w_1^* = \frac{0.0324 - (-0.0072)}{0.01 + 0.0324 - 2(-0.0072)} = \frac{0.0396}{0.0568} \approx 0.697.$$

Compute $\sigma_{MVP} \rightarrow$ about **6.76%** (substantially lower). (Any answer close by with correct method earns full credit.)

Problem 3 (tangency portfolio, two assets)

Assets: $E[R_X]=8\%, \sigma_X=15\%; E[R_Y]=12\%, \sigma_Y=20\%; \rho=0$. $R_f=3\%$.

Find w_T, μ_T, σ_T , and the Sharpe.

Solution.

Using $w_T \propto \Sigma^{-1}(\mu - R_f \mathbf{1})$,

$$w_T \approx (0.430, 0.570), \mu_T \approx 10.28\%, \sigma_T \approx 14.68\%, S \approx 0.496.$$

Problem 4 (Separation theorem—choose y)

With Problem 3's tangency, target $\sigma_C=9\%$, Compute y, E[RC]. Then for $\sigma_C=18\%$ if borrowing is allowed at $R_f=3\%$.

Solution. $y=0.09/0.1468 \approx 0.613$.

$E[RC]=0.03+0.613(0.1028-0.03) \approx 7.43\%$

For 18%: $y \approx 1.226$, $E[RC] \approx 12.07\%$.

Problem 5 (kinked CAL)

Repeat Problem 4 for $\sigma_C=18\%$ but borrowing at 5% (lending still 3%). What changes?

Solution. For $y > 1$ use the borrowing rate:

$E[RC]=0.05+1.226(0.1028-0.05) \approx 11.52\%$. Slope beyond tangency is lower; the CAL **kinks** at $y=1$.

Problem 6 (GMV in 3 assets)

$\mu = (9\%, 10\%, 12\%)$, $\text{vol} = (12\%, 16\%, 22\%)$, correlations

$$\begin{bmatrix} 1 & 0.3 & 0.1 \\ 0.3 & 1 & 0.25 \\ 0.1 & 0.25 & 1 \end{bmatrix}.$$

Compute w_{GMV} .

Solution outline. Build Σ , Compute $\frac{\Sigma^{-1}\mathbf{1}}{\mathbf{1}^\top \Sigma^{-1}\mathbf{1}}$ numerically consistent set of weights summing to 1 and minimizing variance, with method shown, earns full credit.)

Problem 7 (frontier equation)

Show that for unconstrained Markowitz $\sigma^2(\mu_p) = \frac{A\mu_p^2 - 2B\mu_p + C}{D}$ with A,B,C,D as defined earlier.

Solution (sketch). Minimize $w^\top \Sigma w$ s.t. $w^\top \mathbf{1} = 1$ and $w^\top \mu = \mu_p$ via Lagrangian. Solve first-order conditions to get $w(\mu_p) = \alpha(\mu_p)\Sigma^{-1}\mathbf{1} + \beta(\mu_p)\Sigma^{-1}\mu$. Substitute into $w^\top \Sigma w$ and simplify to obtain the quadratic in μ_p with constants A, B, C, D.

Problem 8 (when constraints bind)

Two assets with high positive correlation and $\sigma_1 \ll \sigma_2$. Show that **no-short-selling** can push the constrained MVP to a **corner** at $w_1=1$ if the unconstrained $w_1^* < 0$ or > 1 .

Solution. For two assets the variance is convex in w_1 . If the first-order optimum lies outside $[0,1]$, the minimizing $w_1=1$ over $[0,1]$ is at the nearest boundary, hence a corner solution.

Problem 9 (Sharpe comparisons)

Portfolio A: $\mu_A=9\%$, $\sigma_A=10\%$. Portfolio B: $\mu_B=12\%$, $\sigma_B=16\%$.
 $R_f=3\%$ $R_f=3\%$. Which has higher Sharpe?

Solution. $S_A=(0.09-0.03)/0.10=0.60$.

$S_B=(0.12-0.03)/0.16=0.5625$.

A is better on risk-adjusted terms.

Problem 10 (target return via mixing)

With $R_f=4\%$ and tangency $(\mu_T, \sigma_T)=(11\%, 13\%)$, What is y hits target $E[R_C]=9\%$? What is σ_C .

Solution. $0.09=0.04+y(0.11-0.04) \Rightarrow y=0.05/0.07 \approx 0.7143$.

$\sigma_C=y\sigma_T \approx 0.7143 \times 13\% \approx 9.29\%$.

Problem 11 (sample estimation)

Given 12 monthly returns for two assets, outline steps to estimate, \bar{r} , Σ then compute MVP and tangency weights.

Solution. (i) Compute sample means \bar{r} (ii) Compute sample covariance matrix Σ with $\text{dof}=1$.

(iii) MVP via closed form (two-asset) or $w_{GMV} = \Sigma^{-1} \mathbf{1} / (\mathbf{1}^T \Sigma^{-1} \mathbf{1})$.

(iv) Tangency via $w_T \propto \Sigma^{-1} (\mu - R_f \mathbf{1})$ Normalize to sum to 1.

Modern Portfolio Theory (Markowitz Theory)

Most people agree that holding two stocks is less risky than holding one stock. For example, holding stocks from textile, banking, and electronic companies is better than investing all the money on the textile company's stock. But building up the optimal portfolio is very difficult. Markowitz provides an answer to it with the help of risk and return

relationship.

Assumptions

The individual investor estimates risk on the basis of variability of returns i.e. the variance of returns. Investor's decision is solely based on the expected return and variance of returns only. For a given level of risk, investor prefers higher return to lower return. Likewise, for a given level of return investor prefers lower risk than higher risk.

The Concept

In developing his model, Markowitz had given up the single stock portfolio and introduced diversification. The single security portfolio would be preference if the investor is perfectly certain that his expectation of highest return would turn out to be real. In the world of uncertainty, most of the risk averse investors would like to join Markowitz rather than keeping a single stock, because diversification reduces the risk. This can be shown with the help of the following illustration. Take the stock of ABC company and XYZ company. The returns expected from each company and their probabilities of occurrence, expected returns and the variances are given. The calculation procedure is given in the table.

	Stock ABC	Stock XYZ
Return %	11 or 17	20 or 8
Probability	.5 each return	.5 each return
Expected Return	14	14
Variance	9	36
Standard deviation	3	6

$$\begin{array}{lll}
 \text{ABC Expected return} & = .5 \times 11 + .5 \times 17 & = 14 \\
 \text{XYZ Expected return} & = .5 \times 20 + .5 \times 8 & = 14 \\
 \text{ABC variance} & = .5 (11-14)^2 + .5 (17-14)^2 & = 9 \\
 \text{XYZ variance} & = .5 (20-14)^2 + .5 (8-14)^2 & = 36 \\
 \text{ABC standard deviation} & = \sqrt{\text{Variance}} & = \sqrt{9} = 3 \\
 \text{XYZ standard deviation} & = \sqrt{\text{Variance}} & = \sqrt{36} = 6
 \end{array}$$

ABC and XYZ companies stocks have the same expected return of 14%. XYZ

company's stock is much riskier than ABC stock, because the standard deviation of the former being 6 and latter 3. When ABC return is high XYZ return is low and vice-versa i.e. when there is 17% return from ABC, there would be 8% return from XYZ. Likewise when ABC return is 11% XYZ return is 20%. If a particular investor holds only ABC or XYZ he would stand to lose in the time of bad performance.

Suppose the investor holds two thirds of ABC and one third of XYZ, the return can be calculated as follows

N

$$R_p = \sum X_i R_i$$

t=1

R_p = return on the portfolio

X_i = proportion of total portfolio invested in security 1.

R_i = expected return of security 1.

Let us calculate the expected return for the both the possibilities.

$$\text{Possibility 1} = 2/3 \times 11 + 1/3 \times 20 = 14$$

$$\text{Possibility 2} = 2/3 \times 17 + 1/3 \times 8 = 14$$

In both the situations, the investor stands to gain if the worst occurs, than by holding either of the security individually. Holding two securities may reduce the portfolio risk too. The portfolio risk can be calculated with the help of the following formula.

$$\sigma_p = \sqrt{X_1^2 \sigma_1^2 + X_2^2 \sigma_2^2 + 2 X_1 X_2 (r_{12} X_1 \sigma_2)}$$

σ_p = portfolio standard deviation

X_1 = percentage of total portfolio value in stock X_1

X_2 = percentage of total portfolio value in stock X_2

σ_1 = standard deviation of stock X_1

σ_2 = standard deviation of stock X_2

r_{12} = correlation co-efficient of X_1 and X_2

r_{12} = covariance of X12

$\sigma, \sigma,$

Using the same example given in the return analysis, the portfolio risk can be estimated. Let us assume ABC as X_1 and XYZ as X_2 . Now the covariance is: X_{12}

$$\begin{aligned} \text{Cov of } X_{12} &= 1/N \sum_{t=1}^N (R_1 - R_2)(R_1 - R_2) \\ &= 1/2[(11-14)(20-14)(17-14)(18-14)] \\ &= 1/2 [(-18) + (-18)] = -36/2 = -18 \\ R &= \frac{\text{covariance of } X_{12}}{\sigma_1 \sigma_2} = -18/3 \times 6 = -1 \end{aligned}$$

The correlation co-efficient indicates the similarity or dissimilarity in the behavior of X_1 and X_2 stocks. In correlation, co-variance is not taken as an absolute value but relative to the standard deviation of individual securities. It shows, how much X and Y vary together as a proportion of their combined individual variations measured by σ_1 and σ_2 . In our example, the correlation co-efficient is -1.0 which indicates that there is a perfect negative correlation exists between the securities and they tend to move in the same direction. If the correlation is 1, perfect positive correlation exists between the securities and they tend to in the same direction. If the correlation co-efficient is zero, the securities' returns are independent. Thus, the correlation between two securities depends upon the covariance between the two securities and the standard deviation of each security. Now, let us proceed to calculate the portfolio risk. Combination of two securities reduces the risk factor if less degree of positive correlation exists between them. In our case, the correlation coefficient is -1.

$$\begin{aligned} \sigma_p &= \sqrt{X_1^2 \sigma_1^2 + X_2^2 \sigma_2^2 + 2X_1 X_2 (r_{12} \sigma_1 \sigma_2)} \\ &= \sqrt{(2/3)^2 \times 9 + (1/3)^2 \times 36 + 2 \times 2/3 \times 1/3 (-1 \times 3 \times 6)} \\ &= \sqrt{4 + 4 + (-8)} \\ &= \sqrt{0} \end{aligned}$$

The portfolio risk is nil if the securities are related negatively. This indicates that the risk can be eliminated if the securities are perfectly negatively correlated. The standard deviation of the portfolio is sensitive to (1) the proportions of funds devoted to each stock.

(2) the standard deviation of each security and (3) co-variance between two stocks. The change in portfolio proportions can change the portfolio risk. Taking the same example of ABC and XYZ stock, the portfolio standard deviation is calculated for different proportions.

Stock ABC (X1)	Stock XYZ (X2)	Portfolio Standard Deviation
100	0	3
66.66	33.3	0
50.0	50.0	1.5
0	100	6

By skillful balancing of the investment proportions in different securities, the portfolio risk can be brought down to zero. The proportion to be invested in each security can be found out by $X1 = \sigma_2 \div (\sigma_1 + \sigma_2)$ the precondition is that the correlation co-efficient should be -1.0. Otherwise it is

$$X1 = \frac{\sigma_2^2 - (r_{12} \sigma_1 \sigma_2)}{\sigma_1^2 + \sigma_2^2 - (2 r_{12} \sigma_1 \sigma_2)}$$

If the correlation co-efficient is less than the ratio of smaller standard deviation to larger standard deviation, then the combination of two securities provides a lesser standard deviation of return than when either of the security is taken alone. In our example,

$$-1 < 3/6 \text{ i.e. } -1 < +.50$$

If the standard deviation ratio is 4/6 and the correlation co-efficient is +.8, the combination of securities is not profitable because

$$+8 > 4/6 \text{ i.e. } +8 > .66$$

Varying Degrees of Correlation

Here in order to learn more about the relationship between securities, different degrees of correlation co-efficient are analyzed. Extreme cases like +1, 1, intermediate values and no correlation are calculated for two securities namely X and Y. We assume that the investor has specific amount of money to invest and that can be allocated in any proportion between the securities. Security X has an expected rate of return of 5% and a standard deviation of 4%. While for security Y, the expected return is 8% and the standard deviation of return is 10%.

Let us first work out the expected return and the portfolio risk for different values of correlation coefficients for varying proportions of the securities X and Y. Portfolio return is calculated with the equation:

$$R_p = XxR_x + YyR_y$$

If there is 75% investment on X and 25% on Y, then $R_p = .75(5\%) + 0.25(8\%) = 5.75\%$ then the σ_p would be found out by using equation

$$= \sqrt{3/4 \times 3/4 \times 16 + 1/4 \times 1/4 \times 100 + 2 \times 3/4 \times 1/4 (1 \times 4 \times 10)}$$

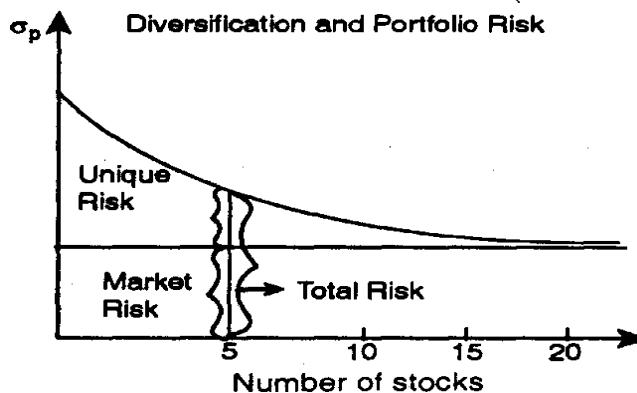
$$= 5.5$$

Table gives the values of R_p and σ_p for varying degrees of correlation co-efficient.

Proportion of X security in portfolio X	Proportion of Y security in portfolio 1-X	R _{prxy}	$\sigma_{R_{xy}}$ +1	$\sigma_{R_{xy}}$ -1	$\sigma_{R_{xy}}$ 0	σ_p +.5
1.00	0.00	5.00	4.0	4.0	4.0	4.0
0.75	0.25	5.75	5.5	0.5	3.9	4.8
0.50	0.50	6.50	7.0	3.0	5.4	6.25
0.25	0.75	7.25	8.5	6.5	7.6	8.1
0.00	1.00	8.00	10.0	10.0	10.0	10.0

Simple Diversification

Portfolio risk can be reduced by the simplest kind of diversification. Portfolio means the group of assets an investor owns. The assets may vary from stocks to different types of bonds. Sometimes the portfolio may consist of securities of different industries. When different assets are added to the portfolio, the total risk tends to decrease. In the case of common stocks, diversification reduces the unsystematic risk or unique risk. Analysts opine that if 15 stocks are added in a portfolio of the investor, the unsystematic risk can be reduced to zero. But at the same time if the number exceeds 15, additional risk reduction cannot be gained. But diversification cannot reduce systematic or undiversifiable risk. The naive kind of diversification is known as simple diversification. In the case of simple diversification, securities are selected at random and no analytical procedure is used. Total risk of the portfolio consists of systematic and unsystematic risk and this total risk is measured by the variance of the rates of returns over time. Many studies have shown that the systematic risk forms one quarter of the total risk. The simple random diversification reduces the total risk. The reason behind this is that the unsystematic price fluctuations are not correlated with the market's systematic fluctuations. The figure shows how the simple diversification reduces the risk. The standard deviations of the portfolios are given in Y axis and the number of randomly selected portfolio securities in the X axis. The standard deviation was calculated for each portfolio and plotted. As the portfolio size increases, the total risk line starts declining. It flattens out after a certain point. Beyond that limit, risk cannot be reduced. This indicates that spreading out the assets beyond certain level cannot be expected to reduce the portfolio's total risk below the level of undiversifiable risk.



Problems of Vast Diversification

Spreading the investment on too many assets will give rise to problems such as purchase of poor performers, information inadequacy, high research cost and transaction cost.

``Purchase of Poor Performers

`While buying numerous stocks, sometimes the investor may also buy stocks that`
`will not yield adequate return.

Information Inadequacy

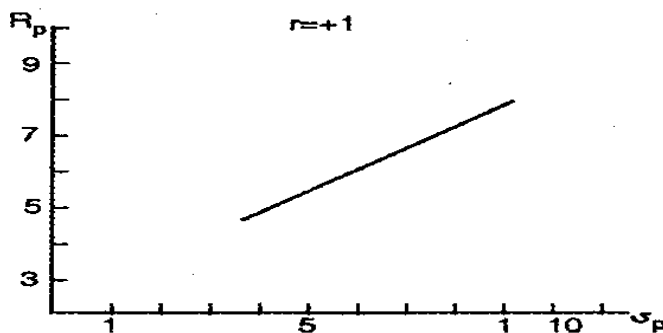
If there are too many securities in a portfolio, it is difficult for the portfolio manager to get information about their individual performance. The portfolio manager has to be in touch with the details regarding the individual company performance. To get all the information simultaneously is quite High research cost
If a large number of stocks are included, before the inclusion itself the returns and risk of the individual stock have to be analysed. Towards this end, lot of information has to be gathered and kept in store and these procedures involve high cost.

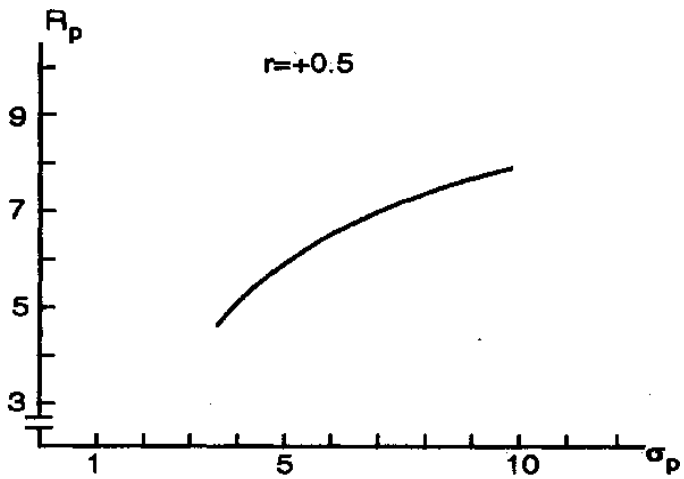
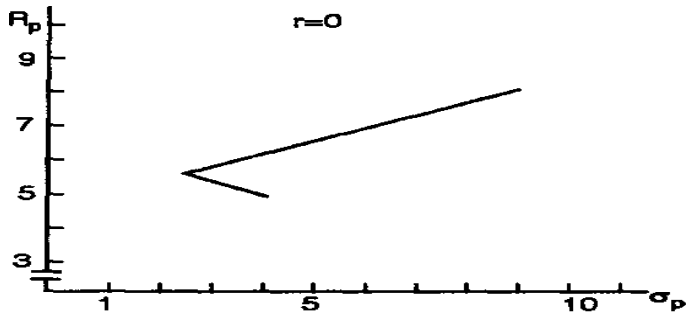
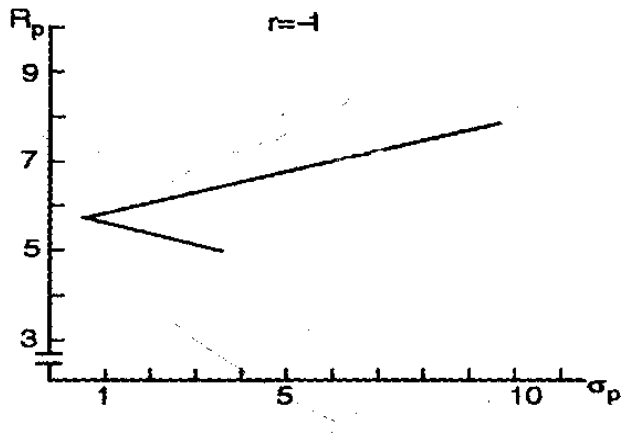
High Transaction Cost

When small quantities of stocks are purchased frequently, the investor has to incur higher transaction cost than the purchase of large blocks at less frequent intervals. In spite of all these difficulties big financial institutions purchase hundreds of different stocks. Likewise, mutual funds also invest in different stocks.

Risk and Return with Different Correlation

The four figures indicate the relationship between risk and return.





For example, take two points on both the line segments K and J. The point K is superior to the point J because with the same level of risk the investor earns more return on point K than on point J. Thus, Markowitz diversification can lower the risk if the securities in the portfolio have low correlation coefficients.

Markowitz Efficient Frontier

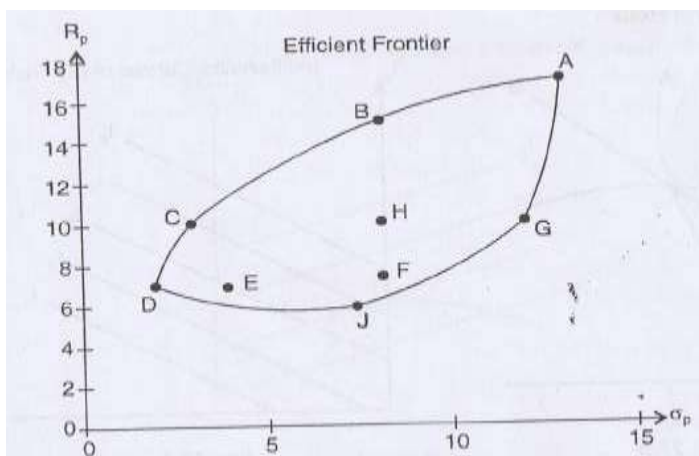
The risk and return of all portfolios plotted in risk-return space would be dominated by efficient portfolios. Portfolio may be constructed from available securities. All the possible combination of expected return and risk compose the attainable set. The following example shows the expected return and risk of different portfolios.

Portfolio Risk and Return

Portfolio	Expected Return (R_p) %	Risk (σ_p)
A	17	13
B	15	8
C	10	3
D	7	7
E	7	4
F	7	8
G	10	12
H	9	8
J	6	7.5

The attainable sets of portfolios are illustrated in figure. Each of the portfolios along the line or within the line ABCDEFGJ is possible. It is not possible for the investor to have portfolio outside of this perimeter because no combination of expected return and risk exists there. When the attainable sets are examined, some are more attractive than others. Portfolio B is more attractive than portfolios F and H because B offers more return on the same level of risk. Likewise, C is more attractive than portfolio G even though same level of return is got in both the points; the risk level is lower at point C. In other words, any portfolio which gives more return for the same level of risk or same return with lower risk is more preferable than any other portfolio. Among all the portfolios, the portfolios which offer the highest return at particular level of risk are called efficient portfolios. Here the

efficient portfolios are A, B, C and D, because at these points no other portfolio offer higher return. The ABCD line is the efficient frontier along which all attainable and efficient portfolios are available. Now the question raised is which portfolio the investor should choose? He would choose a portfolio that maximizes his utility. For that utility analysis has to be done.



Utility Analysis

Utility is the satisfaction the investor enjoys from the portfolio return. An ordinary investor is assumed to receive greater utility from higher return and vice-versa. The investor gets more satisfaction or more utility in $X + 1$ rupees than from X rupee. If he is allowed to choose between two certain investments, he would always like to take the one with larger outcome. Thus, utility increases with increase in return.

The utility function makes certain assumptions about an investors' taste for risk. The investors are categorized into risk averse, risk neutral and risk seeking investor. All the three types can be explained with the help of a fair gamble.

In a fair gamble which cost $\` 1$, the on are A and B events. A event will yield $\` 2$. Occurrence of B event is a dead loss i.e 0. The chance of occurrence of both the events are 50% and 50%.

The expected value of investment is $(1/2) 2 + 1/2 (0) = \text{Re}\>$ the expected

value of the gamble is exactly equal to cost. Hence, it is a fair gamble. The position of the investor may, be improved or hurt by undertaking the gamble. Risk avert or rejects a fair gamble because the disutility of the loss is greater for him than the utility of an equivalent gain. Risk neutral investor means that he is indifferent to whether a fair gamble is undertaken or not.

The risk seeking investor would select a fair gamble i.e. he would choose to invest. The expected utility of investment is higher than the expected utility of not investing. These three different types of investors are shown in figure.

The curves ABC are three different slopes of utility curves. The upward sloping curve A shows increasing marginal utility. The straight-line B shows constant utility, and curve C shows diminishing marginal utility. The constant utility, a linear function means doubling of returns would double the utility and it indicates risk neutral situation. The increasing marginal utility suggests that the utility increases more than proportion to increase in return and shows the risk lover. The curve C shows risk averse investor. The utility he gains from additional return declines gradually. The figures show the utility curves of the different investors.

$$RP = \frac{\sum_{t=1}^N x_i(a_i + \beta_i R_m)}{\sum_{t=1}^N x_i}$$

Portfolio return is the weighted average of the estimated return for each security in the portfolio. The f weights are the respective stocks' proportions in the portfolio. A portfolio's alpha value is a weighted average of the alpha values for its component securities using the F proportion of the investment in a security as weight.

$$\sigma_p = \frac{\sum_{t=1}^N x_i \alpha_i}{\sum_{t=1}^N x_i}$$

σ_p - Value of the alpha for the portfolio

x_i - Proportion of the investment on security i

α_i - Value of alpha for security i

N - The number of securities in the portfolio

Similarly, a portfolio's beta value is the weighted average of the beta values of its component stocks using relative share of them in the portfolio as weights.

$$\sigma_p = \sum_{t=1}^N x_{it} \beta_t$$

β_p is the portfolio beta.

Sharpe's Optimal Portfolio

Sharpe had provided a model for the selection of appropriate securities in a portfolio.

The selection of any stock is directly related to its excess return-beta ratio.

$$\frac{R_i - R_f}{\beta_i}$$

Where

R_i = the expected return on stock i

R_f = the return on a riskless asset

β_i = the expected change in the rate of return on stock i associated with one unit change in the market return

The excess return is the difference between the expected return on the stock and the riskless rate of interest such as the rate offered on the government security or treasury bill. The excess return to beta ratio measures the additional return on a security (excess of the riskless asset return) per unit of systematic risk or non-diversifiable risk. This ratio provides a relationship between potential risk and reward. Ranking of the stocks are done on the basis of their excess return to beta. Portfolio managers would like to include stocks with higher ratios. The selection of the stocks depends on a unique cut-off rate such that all stocks with higher ratios of $R_i - R_f / \beta_i$ are included and the stocks with lower ratios are left off. The cut-off point is denoted by C^* . The steps for finding out the stocks to be included in the optimal portfolio are given below

1. Find out the “excess return to beta” ratio for each stock under consideration.
2. Rank them from the highest to the lowest.
3. Proceed to calculate C for all the stocks according to the ranked order using the following formula.

$$C_i = \frac{\sigma_m^2 \sum_{i=1}^N (R_i - R_f) \beta_i}{1 + \sigma_m^2 \sum_{i=1}^N \frac{\beta_i^2}{\sigma_{ei}^2}}$$

σ_m^2 = variance of the market index

σ_{ei}^2 = variance of a stock’s movement that is not associated with the movement of

market index i.e. stock’s unsystematic risk.

4. The cumulated values of C start declining after a particular C and that point is taken as the cut-off point and that stock ratio is the cut-off ratio C.

This is explained with the help of an example.

Data for finding out the optimal portfolio are given below:

Security Number	Mean Return R_i	Excess Return $R_i - R_f$	Beta β	Unsystematic Risk σ_{ei}^2	Excess Return to Beta $\frac{R_i - R_f}{\beta_i}$
1	19	14	1.0	20	14
2	23	18	1.5	30	12
3	11	6	0.5	10	12
4	25	20	2.0	40	10
5	13	8	1.0	20	8
6	9	4	0.5	50	8
7	14	9	1.5	30	6

The riskless rate of interest is 5 per cent and the market variance is 10. Determine the cut-off point.

Security Number	$R_i - R_f$	$\frac{(R_i - R_f) \times \beta_i}{\sigma_{e_i}^2}$	$\frac{\sum_{i=1}^N (R_i - R_f) \beta_i}{\sigma_{e_i}^2}$	$\frac{\beta_i^2}{\sigma_{e_i}^2}$	$\frac{\beta_i^2}{\sigma_{e_i}^2}$	c_i
1	14	0.7	0.7	0.05	0.05	4.67
2	12	0.9	1.6	0.075	0.125	7.11
3	12	0.3	1.9	0.025	0.15	7.60
4	10	1.0	2.9	0.1	0.25	8.29
5	8	0.4	3.3	0.05	0.3	8.25
6	8	0.04	3.34	0.005	0.305	8.25
7	6	0.45	3.79	0.075	0.38	7.90

C calculations are given below For Security 1

$$C = \frac{10 \times 0.7}{1 + (10 \times 0.05)} = 4.67$$

Here 0.7 is got from column 4 and 0.05 from column 6. Since the preliminary calculations are over, it is easy to calculate the C

$$C = \frac{10 \times 1.6}{1 + (10 \times 0.125)} = 7.11$$

$$C = \frac{10 \times 1.9}{1 + (10 \times 0.125)} = 7.11$$

$$C = \frac{10 \times 2.9}{1 + (10 \times 0.25)} = 8.2$$

$$C = \frac{10 \times 3.3}{1 + (10 \times 0.3)} = 8.25$$

$$C = \frac{10 \times 3.34}{1 + (10 \times 0.305)} = 8.25$$

$$C = \frac{10 \times 3.79}{1 + (10 \times 0.38)} = 7.90$$

The highest C_i value is taken as the cutoff point i.e. C^* . The stocks ranked above C^* have high excess returns to beta than the cut-off C . and all the stocks ranked below C^* have low excess returns to beta. Here, the cut-off rate is 8.29. Hence, the first four securities are selected. If the number of stocks is larger there is no need to calculate C_i values for all the stocks after the ranking has been done. It can be calculated until the C^* value is found and after calculating for one or two stocks below it, the calculations can be terminated. The C_i can be stated with mathematically equivalent way.

$$C = \frac{\beta_i (R_p - R_f)}{1}$$

β_i - the expected change in the rate of return on stock i associated with 1 per cent change in the return on the optimal portfolio.

R_p - the expected return on the optimal portfolio

β_i and R_p cannot be determined until the optimal portfolio is found. To find out the optimal portfolio, the formula given previously should be used. Securities are added to the portfolio as long as

$$\frac{R_i - R_f}{\beta_i} > C$$

The above equation can be rearranged with the substitution of equation:

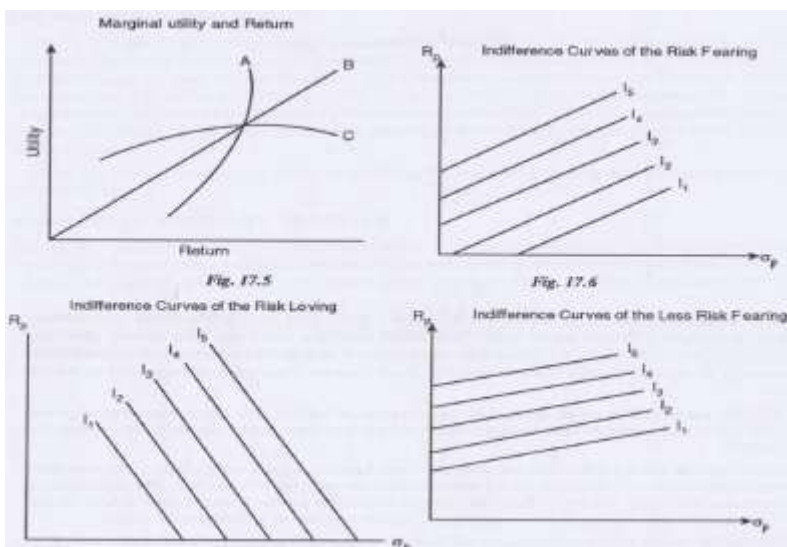
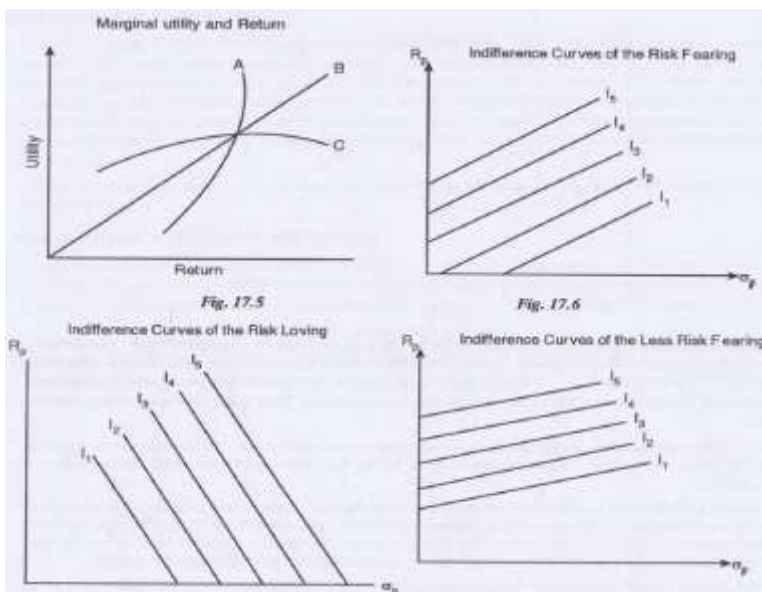
$$C = \frac{\beta_i (R_p - R_f)}{1}$$

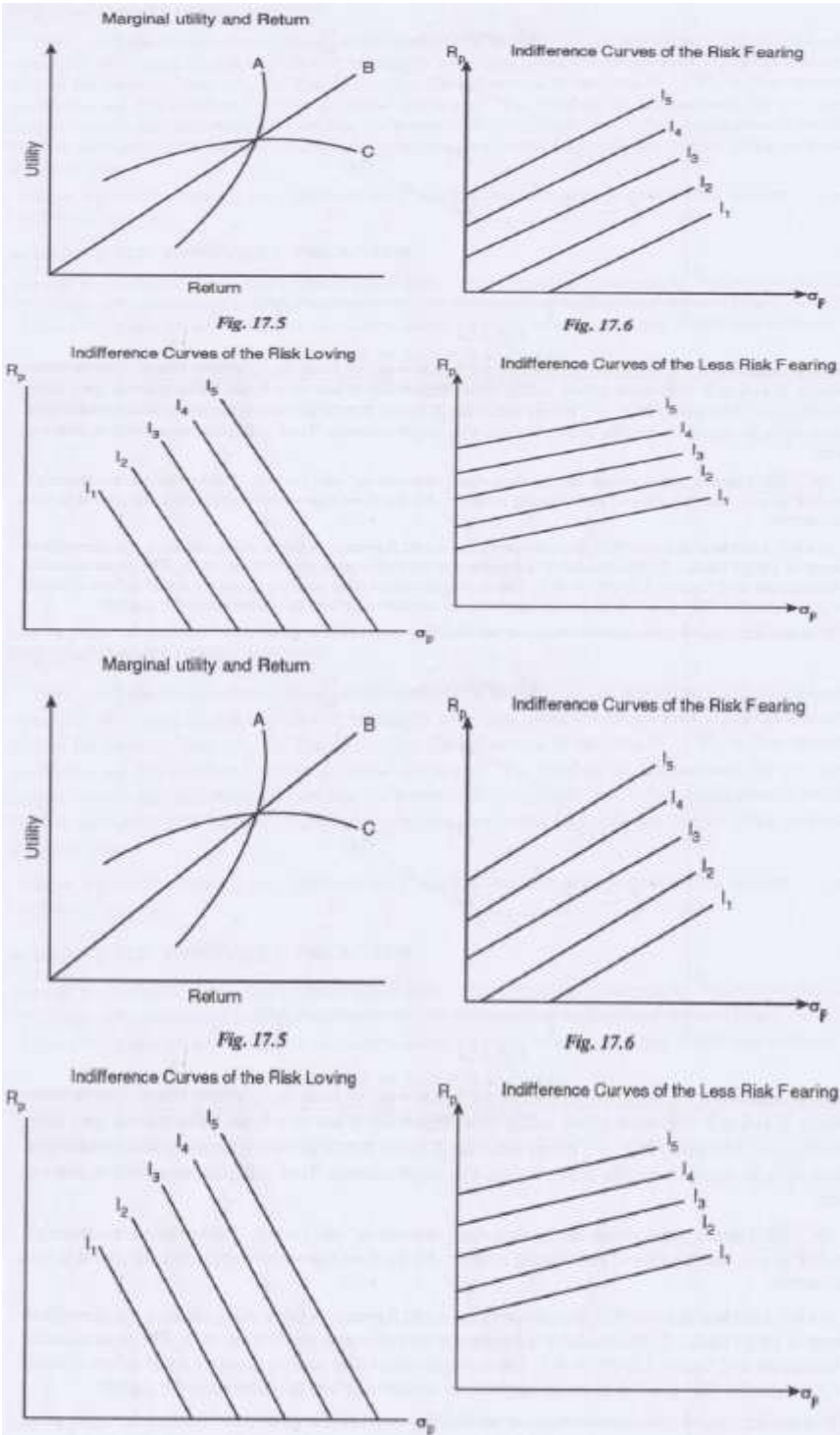
Now we have,

$$R_i - R_f > \beta_i (R_p - R_f)$$

The right hand side is the expected excess return on a particular stock based on the expected performance of the optimum portfolio. The term on the left hand side is the expected excess return on the individual stock. Thus, if the portfolio manager believes that a particular stock will perform better than the expected return based on its relationship to optimal

portfolio, he would add the stock to the portfolio.

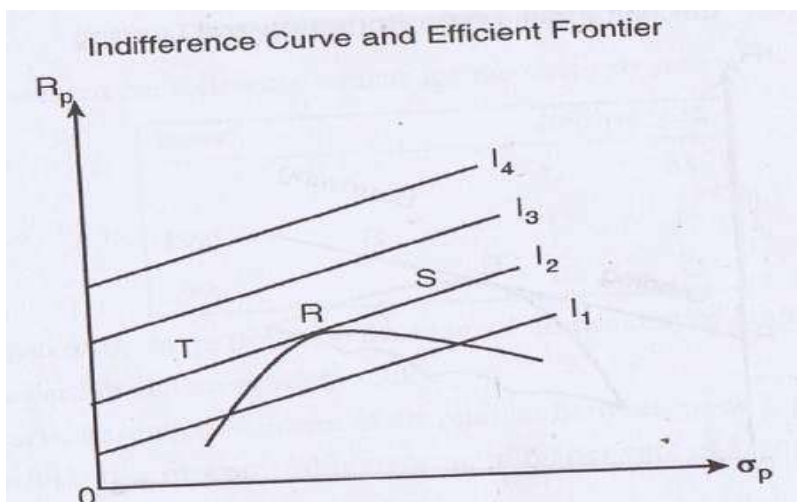




Investors generally like to get more returns for additional risks assumed and the lines would be positively sloped. The risk lover's utility curves are negatively sloped and converge towards the origin. For the risk fearing, lower the risk of the portfolio, happier he would be. The degree of the slope of indifference curve indicates the degree of risk aversion. The conservative investor needs larger return to undertake small increase in risk (Figure) The aggressive investor would be willing to undertake greater risk for smaller return. Even though the investors dislike risk, their trade-off between risk and return differs.

Indifference Map and the Efficient Frontier

Each investor has a series of indifference curves. His final choice out of the efficient set depends on his attitude towards risk. The figure shows the efficient frontier and the indifference map.



The utility of the investor or portfolio manager increases when he moves up the indifference map from I to I4. He can achieve higher expected return without an increase in risk. In the figure 122 touches the efficient frontier at point R. Even though the points I and S are in the I1 curve, R is the only attainable portfolio which maximises the utility of the investor. Thus, the point at which the efficient frontier tangentially touches the highest indifference curve determines the most attractive portfolio for the investor.

Leveraged Portfolios

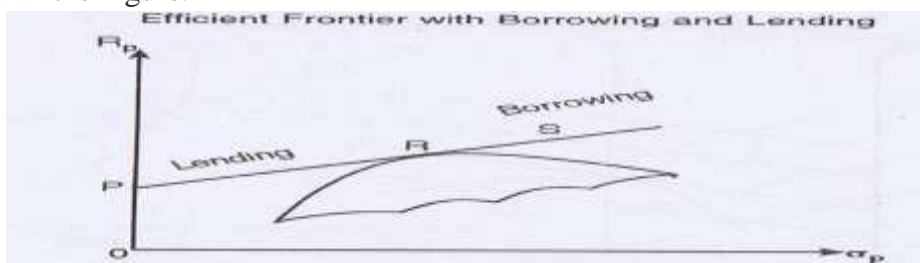
In the above model, the investor is assumed to have a certain amount of money to make investment for a fixed period of time. There is no borrowing and lending opportunities. When the investor is not allowed to use the borrowed money, he is denied the opportunity of having financial leverage. Again, the investor is assumed to be investing only on the risky assets. Riskless assets are not included in the portfolio. To have a leveraged portfolio, investor has to consider not only risky assets but also risk-free assets. Secondly, he should be able to borrow and lend money at a given rate of interest.

What is Risk Free Asset?

The features of risk-free asset are: (a) absence of default risk and interest risk and (b) full payment of principal and interest amount. The return from the risk-free asset is certain and the standard deviation of the return is nil. The relationship between the rate of return of the risk-free asset and risky asset is zero. These types of assets are usually fixed income securities. But fixed income securities issued by private institutions have the chance of default. If the fixed income securities are from the government, they do not possess the default risk and the return from them are guaranteed. Further, the government issues securities of different maturity period to match the length of investors holding period. The risk-free assets may be government securities, treasury bills and time deposits in banks.

Inclusion of Risk-Free Asset

Now, the risk-free asset is introduced and the investor can invest part of his money on risk free asset and the remaining amount on the risky asset. It is also assumed that the investor would be able to borrow money at risk free rate of interest. When risk free asset is included in the portfolio, the feasible efficient set of the portfolios is altered. This can be explained in the Figure.



In the figure, OP is gained with zero risk and the return is earned through holding risk free asset. Now, the investor would attempt to maximise his expected return and risk relationship by purchasing various combinations of riskless asset and risky assets. He would be moving on the line connecting attainable portfolio R and risk-free portfolio P i.e. the line PR. When he is on the PR, part of his money is invested in fixed income securities i.e. he has lent some amount of money and invested the rest in the risky asset within the point PR. He is depending upon his own funds. But if he moves beyond the point R to S he would be borrowing money. Hence the portfolios located between the points RP are lending portfolios and beyond the point R consists of borrowing portfolios. Holding portfolio in PR segment with risk free securities would actually reduce risk more than the reduction in return.

Single Index Model

Casual observation of the stock prices over a period of time reveals that most of the stock prices move with the market index. When the Sensex increases, stock prices also tend to increase and vice-versa. This indicates that some underlying factors affect the market index as well as the stock prices. Stock prices are related to the market index and this relationship could be used to estimate the return on stock. Towards this purpose, the following equation can be used

$$R_i = \alpha_i + \beta_i R_m + e_i$$

where

R_i - expected return on security i

α_i - intercept of the straight line or alpha

co-efficient β_i - slope of straight line or beta
co-efficient

R_m - the rate of return on

market index e_i - error

term

According to the equation, the return of a stock can be divided into t

components, the return due to the market and the return independent of the market. β_i indicates the sensitiveness of the stock return to the changes in the market return. For example, β_i of 1.5 means that the stock returns are expected to increase by 1.5% when the market index return increases by 1% and vice-versa. Likewise, β_i of 0.5 expresses that the individual stock return would change by 0.5 per cent when there is a change of 1 per cent in the market return. β_i of 1 indicate that the market return and the security return are moving in tandem. The estimates of β_i and α_i are obtained from regression analysis. The single index model is based on the assumption that stocks vary together because of the common movement in the stock market and there are no effects beyond the market (i.e. any fundamental factor effects) that account the stocks co-movement. The expected return, standard deviation and co-variance of the single index model represent the joint movement of securities. The mean return is

$$R_i = \alpha_i + \beta_i R_m + e_i$$

The variance of security's return, $\sigma_i^2 = \beta_i^2 \sigma_m^2 + \sigma_{e_i}^2$

The covariance of returns

between securities i and j is $\sigma_{ij} =$

$$\beta_i \beta_j \sigma_m^2$$

The variance of the security has two components namely, systematic risk or market risk and unsystematic risk or unique risk. The variance explained by the index is referred to systematic risk. The unexplained variance is called residual variance or unsystematic risk. Systematic risk = $\beta_i^2 \times$ variance of market index.

$$= \beta_i^2 \sigma_m^2$$

Unsystematic risk = Total variance

— Systematic risk. $e_i^2 = \sigma_{e_i}^2$

β_i^2 - systematic risk.

Thus, the total risk = Systematic risk + Unsystematic risk.

$$\sigma_p^2 = \beta_i^2 \sigma_m^2 + e_i^2$$

From this, the portfolio variance can be derived

σ_p^2 = variance of portfolio

$$\sigma_p^2 = \beta_i^2 \sigma_m^2 + e_i^2$$

= expected variance of index

e_i^2 = variation in security's return not related to the market

index x_i = the portion of stock i in the portfolio

Likewise expected return on the portfolio also can be estimated. For each security α_i and β_i should be estimated. N

$$RP = \frac{\sum_{t=1}^N x_i (\alpha_i + \beta_i R_{m,t})}{\sum_{t=1}^N x_i}$$

Portfolio return is the weighted average of the estimated return for each security in the portfolio. The x_i weights are the respective stocks' proportions in the portfolio. A portfolio's alpha value is a weighted average of the alpha values for its component securities using the x_i proportion of the investment in a security as weight.

$$\sigma_p = \frac{\sum_{t=1}^N x_i \alpha_i}{\sum_{t=1}^N x_i}$$

σ_p - Value of the alpha for the portfolio

x_i - Proportion of the investment on security i

α_i - Value of alpha for security i

N - The number of securities in the portfolio

Similarly, a portfolio's beta value is the weighted average of the beta values of its component stocks using relative share of them in the portfolio as weights.

$$\sigma_p = \sum_{t=1}^N x_{it} \beta_i$$

β_p is the portfolio beta.

Sharpe's Optimal Portfolio

Sharpe had provided a model for the selection of appropriate securities in a portfolio.

The selection of any stock is directly related to its excess return-beta ratio.

$$\frac{R_i - R_f}{\beta_i}$$

Where

R_i = the expected return on stock i

R_f = the return on a riskless asset

β_i = the expected change in the rate of return on stock

i = associated with one unit change in the market return

The excess return is the difference between the expected return on the stock and the riskless rate of interest such as the rate offered on the government security or treasury bill. The excess return to beta ratio measures the additional return on a security (excess of the riskless asset return) per unit of systematic risk or non-diversifiable risk. This ratio provides a relationship between potential risk and reward. Ranking of the stocks are done on the basis of their excess return to beta. Portfolio managers would like to include stocks with higher ratios. The selection of the stocks depends on a unique cut-off rate such that all stocks with higher ratios of $R_i - R_f / \beta_i$ are included and the stocks with lower ratios are left off. The cut-off point is denoted by C^* .

The steps for finding out the stocks to be included in the optimal portfolio are given below

Find out the "excess return to beta" ratio for each stock under consideration. Rank them from the highest to the lowest.

Proceed to calculate C for all the stocks according to the ranked order using the following formula.

$$C_i = \frac{\sigma_m^2 \sum_{i=1}^N (R_i - R_f) \beta_i}{1 + \sigma_m^2 \sum_{i=1}^N \frac{\beta_i^2}{\sigma_{ei}^2}}$$

σ_m^2 = variance of the market index

σ_{ei}^2 = variance of a stock's movement that is not associated with the movement of market index i.e. stock's unsystematic risk.

The cumulated values of C start declining after a particular C and that point is taken as the cut-off point and that stock ratio is the cut-off ratio C.

This is explained with the help of an example.

Data for finding out the optimal portfolio are given below:

Security Number	Mean Return R_i	Excess Return $R_i - R_f$	Beta β	Unsystematic Risk σ_{ei}^2	Excess Return to Beta $\frac{R_i - R_f}{\beta_i}$
1	19	14	1.0	20	14
2	23	18	1.5	30	12
3	11	6	0.5	10	12
4	25	20	2.0	40	10
5	13	8	1.0	20	8
6	9	4	0.5	50	8
7	14	9	1.5	30	6

The riskless rate of interest is 5 per cent and the market variance is 10. Determine the cut-off point.

Security Number	$\frac{R_i - R_f}{\beta_i}$	$\frac{(R_i - R_f) \times \beta_i}{\sigma e_i^2}$	$\Sigma \frac{N (R_i - R_f) \beta_i}{i=1 \sigma e_i^2}$	$\frac{\beta_i^2}{\sigma e_i^2}$	$\frac{\beta_i^2}{\sigma e_i^2}$	c_i
1	14	0.7	0.7	0.05	0.05	4.67
2	12	0.9	1.6	0.075	0.125	7.11
3	12	0.3	1.9	0.025	0.15	7.60
4	10	1.0	2.9	0.1	0.25	8.29
5	8	0.4	3.3	0.05	0.3	8.25
6	8	0.04	3.34	0.005	0.305	8.25
7	6	0.45	3.79	0.075	0.38	7.90

C calculations are given below For Security 1

$$C_1 = \frac{10 \times 0.7}{1 + (10 \times 0.05)} = 4.67$$

Here 0.7 is got from column 4 and 0.05 from column 6. Since the preliminary calculations are over, it is easy to calculate the C

$$C_2 = \frac{10 \times 1.6}{1 + (10 \times 0.125)} = 7.11$$

$$C_3 = \frac{10 \times 1.9}{1 + (10 \times 0.125)} = 7.11$$

$$C_4 = \frac{10 \times 2.9}{1 + (10 \times 0.25)} = 8.2$$

$$C_5 = \frac{10 \times 3.3}{1 + (10 \times 0.3)} = 8.25$$

$$C_6 = \frac{10 \times 3.34}{1 + (10 \times 0.305)} = 8.25$$

$$C_7 = \frac{10 \times 3.79}{1 + (10 \times .38)} = 7.90$$

The highest C_i value is taken as the cutoff point i.e. C^* . The stocks ranked above C^* have high excess returns to beta than the cut-off C . and all the stocks ranked below C^* have low excess returns to beta. Here, the cut-off rate is 8.29. Hence, the first four securities are selected. If the number of stocks is larger there is no need to calculate C_i values for all the stocks after the ranking has been done. It can be calculated until the C^* value is found and after calculating for one or two stocks below it, the calculations can be terminated.

The C_i can be stated with mathematically equivalent way.

$$C_i = \frac{\beta_i (R_p - R_f)}{\beta_i}$$

β_i - the expected change in the rate of return on stock i associated with 1 per cent change in the return on the optimal portfolio.

R_p - the expected return on the optimal portfolio

β_i and R_p cannot be determined until the optimal portfolio is found. In find out the optimal portfolio, the formula given previously should be used. Securities are added to the portfolio as long as

$$\frac{R_i - R_f}{\beta_i} > C$$

The above equation can be rearranged with the substitution of equation:

$$C = \frac{\beta_i (R_p - R_f)}{\beta_i}$$

Now we have,

$$R_i - R_f > \beta_i (R_p - R_f)$$

The right-hand side is the expected excess return on a particular stock based on the expected performance of the optimum portfolio. The term on the left-hand side is the expected excess return on the individual stock. Thus, if the portfolio manager believes that a particular stock will perform better than the expected return based on its relationship to optimal portfolio, he would add the stock to the portfolio.

CHAPTER V

PORTFOLIO CONSTRUCTION

Portfolio is a combination of securities such as stocks, bonds and money market instruments. The process of blending together the broad asset classes so as to obtain optimum return with minimum risk is called portfolio construction. Diversification of investments helps to spread risk over many assets. A diversification of securities gives the assurance of obtaining the anticipated return on the portfolio. In a diversified portfolio, some securities may not perform as expected, but others may exceed the expectation and making the actual return of the portfolio reasonably close to the anticipated one. Keeping a portfolio of single security may lead to a greater livelihood of the actual return somewhat different from that of the expected return. Hence, it is a common practice to diversify securities in the portfolio.

Approaches in Portfolio Construction

Commonly, there are two approaches in the construction of the portfolio of securities viz, traditional approach and Markowitz efficient frontier approach. In the traditional approach, investor's needs in terms of income and capital appreciation re evaluated and appropriate securities are selected to meet the needs of the investor. The common practice in the traditional approach is to evaluate the entire financial plan of the individual. In the modern approach, portfolios are constructed to maximize the expected return for a given level of risk. It views portfolio construction in terms of the expected return and the risk associated with obtaining the expected return.

The Traditional Approach

The traditional approach basically deals with two major decisions. They are:

- (a) Determining the objectives of the portfolio.
- (b) Selection of securities to be included in the portfolio.

Normally, this is carried out in four to six steps. Before formulating the objectives, the constraints of the investor should be analyzed. Within the given frame work of constraints, objectives are formulated. Then based on the objectives, securities are selected. After that, the risk and return of the securities should be studied. The investor has to assess the major risk categories that he or she is trying to minimize. Compromise on risk and non-risk factors have to be carried out. Finally relative portfolio weights are assigned to securities like bonds, stocks and debentures and then diversification is carried out. The flow chart 4.5 explains this

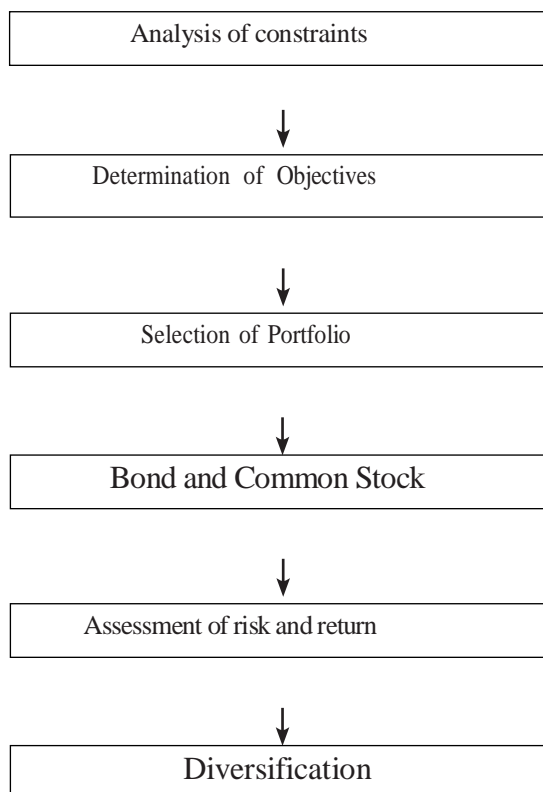
Analysis of Constraints

The constraints normally discussed are: income needs, liquidity time horizon, safety, tax considerations and the temperament.

Income Needs

The income needs depend on the need for income in constant rupees and current rupees. The need for income in current rupees arises from the investor's need to meet all or part of the living expenses. At the same time inflation may erode the purchasing power, the investor may like to offset the effect of the inflation and so, needs income in constant rupees.

Steps In Traditional Approach



(a) Need for current

Income The investor should establish the income which the portfolio should generate. The current income need depends upon the entire current financial plan of the investor. The expenditure required to maintain a certain level of standard of living and the other entire income generating source should

be determined. Once this information is arrived at, it is possible to decide how much income must be provided for the portfolio of securities.

(b) Need for Constant Income

Inflation reduces the purchasing power of the money. Hence, the investor estimates the impact of inflation on his estimated stream of income and tries to build a portfolio which could offset the effect of inflation. Funds should be invested in such securities where income from them might increase at a rate that would offset the effect of inflation. The inflation or purchasing power risk must be recognized but this does not pose a serious constraint on portfolio if growth stocks are selected.

Liquidity

Liquidity need of the investment is highly individualistic of the investor. If the investor prefers to have high liquidity, then funds should be invested in high-quality short-term debt maturity issues such as money market funds, commercial papers and shares that are widely traded. Keeping the funds in shares that are poorly traded or stocks in closely held business and real estate lack liquidity. The investor should plan his cash drain and the need for net cash inflows during the investment period.

Safety of the Principal

Another serious constraint to be considered by the investor is the safety of the principal value at the time of liquidation. Investing in bonds and debentures is safer than investing in the stocks. Even among the stocks, the money should be invested in regularly traded companies of longstanding. Investing money in the unregistered finance companies may not provide adequate safety

Time Horizon

Time horizon is the investment-planning period of the individuals. This varies from individual to individual. Individual's risk and return preferences are often described in terms of his "life cycle". The stages of the life cycle determine the nature of investment. The first stage is the early career situation. At the career starting point assets are lesser than their liabilities. More goods are purchased on credit. His house might have been built with the help of housing loan scheme. His major asset may be the house he owns. His priority towards investments may be in the form of savings for liquidity

purposes. He takes life insurance for protecting him from unforeseen events like death and accidents and then he thinks of the investments. The investor is young at this stage and has long horizon of life expectancy with possibilities of growth in income, he can invest in high-risk and growth-oriented investments. The other stage of the time horizon is the mid-career individual. At this stage, his assets are larger than his liabilities. Potential pension benefits are available to him. By this time he establishes his investment program. The time horizon before him is not as long as the earlier stage and he wants to protect his capital investment. He may wish to reduce the overall risk exposure of the portfolio but, he may continue to invest in high risk and high return securities. The final stage is the late career or the retirement stage. Here, the time horizon of the investment is very much limited. He needs stable income and once he retires, the size of income he needs from investment also increases. In this stage, most of his loans are repaid by him and his assets far exceed the liabilities. His pension and life insurance programmes are completed by him. He shifts his investment to low return and low risk category investments, because safety of the principal is given priority. Mostly he likes to have lower risk with high interest or dividend paying component to be included in his portfolio. Thus, the time horizon puts restrictions on the investment decisions.

Tax Consideration

Investors in the income tax paying group consider the tax concessions they could get from their investments. For all practical purpose, they would like to reduce the taxes. For income tax purpose, interests and dividends are taxed under the head “income from other sources”. The capital appreciation is taxed under the head “capital gains” only when the investor sells the securities and realises the gain. The tax is then at a concessional rate depending on the period for which the asset has been held before being sold. From the tax point of view, the form in which the income is received i. e. interest, dividend, short term capital gains and long term capital gains are important. If the investor cannot avoid taxes, he can delay the taxes. Investing in government bonds and NSC can avoid taxation. This constraint makes the investor to include the items which will reduce the tax.

Temperament

The temperament of the investor himself poses a constraint on framing his investment objectives. Some investors are risk lovers or takers who would like to take up higher risk even for low return while some investors are risk averse, who

may not be willing to undertake higher level of risk even for higher level of return. The risk neutral investors match the return and the risk. For example, if a stock is highly volatile in nature then the stock may be selling in a range of ` 100 - 200 and returns may fluctuate. Investors who are risk averse would find it disturbing and do not have the temperament to invest in this stock. Hence, the temperament of the investor plays an important role in setting the objectives.

Determination of Objectives

Portfolios have the common objective of financing present and future expenditures from a large pool of assets. The return that the investor requires and the degree of risk he is willing to take depend upon the constraints. The objectives of portfolio range from income to capital appreciation. The common objectives are stated below

- => Current income
- => Growth in income
- => Capital appreciation
- => Preservation of capital

The investor in general would like to achieve all the four objectives; nobody would like to lose his investment. But, it is not possible to achieve all the four objectives simultaneously. If the investor aims at capital appreciator, he should include risky securities where there is an equal likelihood of losing the capital. Thus, there is a conflict among the objectives.

Selection of Portfolio

The selection of portfolio depends on the various objectives of the investor. The selections of portfolio under different objectives are dealt subsequently.

Objectives and Asset Mix

If the main objective is getting adequate amount of current income, sixty per cent of the investment is made on debts and 40 per cent on equities. The proportions of investments on debt and equity differ according to the individual's preferences. Money is invested in short term debt and fixed income securities. Here the growth of income becomes the secondary objective and stability of principal amount may become the third. Even within the debt portfolio, the funds invested in short term bonds depends on the need for stability of principal amount in comparison with the stability of income. If the appreciation of capital is given third priority, instead of short-term debt the investor opts for

long term debt. The maturity period may not be a constraint.

Growth and Income and Asset Mix

Here the investor requires a certain percentage of growth in the e received from his investment. The investor's portfolio may consist of 60 to 100 percent equities and 0 to 40 percent debt instrument. The debt portion of the portfolio may consist of concession regarding tax exemption. Appreciation of principal amount is given third priority. For example computer software, hardware and non-conventional energy producing company shares provide good possibility of growth in dividend.

Capital Appreciation and Asset Mix

Capital appreciation and asset mix Capital appreciation means that the value of the original investment increases over the years. Investment in real estates like land and house may provide a faster rate of capital appreciation but they lack liquidity. In the capital market, the values of the shares are much higher than their original issue prices. For example, Satyam Computers, share value was ` 306 in April 1998 but in October 1999 the value was ` 1658. Likewise, several examples can be cited. The market capitalization also has increased. Next to real assets, the stock markets provide best opportunity for capital appreciation. If the investor's objective is capital appreciation, 90 to 100 per cent of his portfolio may consist of equities and 0-10% of debts. The growth of income becomes the secondary objective.

Safety of Principal and Asset Mix

Usually, the risk averse investors are very particular about the stability of principal. According to the life cycle theory, people in the third stage of life also give more importance to the safety of the principal. All the investors have this objective in their mind. No one likes to lose his money invested in different assets. But, the degree may differ. The investor's portfolio may consist more of debt instruments and within the debt portfolio more would be on short term debts.

Risk and Return Analysis

The traditional approach to portfolio building has some basic assumptions. First, the individual prefers larger to smaller returns from securities. To achieve this goal, the investor has to take more risk. The ability to achieve higher returns is dependent upon his ability to judge risk and his ability to

take specific risks. The risks are namely interest rate risk, purchasing power risk, financial risk and market risk. The investor analyses the varying degrees of risk and constructs his portfolio. At first, he establishes the minimum income that he must have to avoid hardships under most adverse economic condition and then he decides risk of loss of income that can be tolerated. The investor makes a series of compromises on risk and non-risk factors like taxation and marketability after he has assessed the major risk categories, which he is trying to minimize.

Diversification

Once the asset mix is determined and the risk and return are analysed, the final step is the diversification of portfolio. Financial risk can be minimized by commitments to top-quality bonds, but these securities offer poor resistance to inflation. Stocks provide better inflation protection than bonds but are more vulnerable to financial risks. Good quality convertibles may balance the financial risk and purchasing power risk. According to the investor's need for income and risk tolerance level portfolio is diversified. In the bond portfolio, the investor has to strike a balance between the short term and long-term bonds. Short term fixed income securities offer more risk to income and long-term fixed income securities offer more risk to principal. The investor has to select the industries appropriate to his investment objectives. Each industry corresponds to specific goals of the investor. The sales of some industries like two wheelers and steel tend to move in tandem with the business cycle, the housing industry sales move counter cyclically. If regular income is the criterion, then industries, which resist the trade cycle should be selected. Likewise, the investor has to select one or two companies from each industry. The selection of the company depends upon its growth, yield, expected earnings, past earnings, expected price earnings ratio, dividend and the amount spent on research and development. Selecting the best company is widely followed by all the investors but this depends upon the investors' knowledge and perceptions regarding the company. The final step in this process is to determine the number of shares of each stock to be purchased. This involves determining the number of different stocks that is required to give adequate diversification. Depending upon the size of the portfolio, equal amount is allocated to each stock. The investor has to purchase round lots to avoid transaction costs.

Modern Approach

The traditional approach is a comprehensive financial plan for the

individual. It takes into account the individual needs such as housing, life insurance and pension plans. But these types of financial planning approaches are not done in the Markowitz approach. Markowitz gives more attention to the process of selecting the portfolio. His planning can be applied more in the selection of common stocks portfolio than the bond portfolio. The stocks are not selected on the basis of need for income or appreciation. But the selection is based on the risk and return analysis. Return includes the market return and dividend. The investor needs return and it may be either in the form of market return or dividend. They are assumed to be indifferent towards the form of return. From the list of stocks quoted at the Bombay Stock Exchange or at any other regional stock exchange, the investor selects roughly some group of shares say of 10 or 15 stocks. For these stocks' expected return and risk would be calculated. The investor is assumed to have the objective of maximizing the expected return and minimizing the risk. Further, it is assumed that investors would take up risk in a situation when adequately rewarded for it. This implies that individuals would prefer the portfolio of highest expected return for a given level of risk. In the modern approach, the final step is asset allocation process that is to choose the portfolio that meets the requirement of the investor. The risk taker i.e. who are willing to accept a higher probability of risk for getting the expected return would choose high risk portfolio. Investor with lower tolerance for risk would choose low level risk portfolio. The risk neutral investor would choose the medium level risk portfolio.

Managing the Portfolio

After establishing the asset allocation, the investor has to decide how to manage the portfolio over time. He can adopt passive approach or active approach towards the management of the portfolio. In the passive approach the investor would maintain the percentage allocation for asset classes and keep the security holdings within its place over the established holding period. In the active approach the investor continuously assess the risk and return of the securities within the asset classes and changes them. He would be studying the risks (1) market related (2) group related and (3) security specific and changes the components of the portfolio to suit his objectives.

Construction of the Optimal Portfolio

After determining the securities to be selected, the portfolio manager should find out how much should be invested in each security. The percentage of funds

to be invested in each security can be estimated as follows:

$$X_i = \frac{Z_i}{\sum_{i=1}^n Z_i}$$

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2} \left(\frac{R_i - R_f}{\beta_i} - C^* \right)$$

The first expression indicates the weights on each security and they sum up to one. The second shows the relative investment in each security. The residual variance or the unsystematic risk has a role in determining the amount to be invested in each security. Taking up the previous example

$$\begin{aligned} Z_1 &= 1/20 (14 - 8.29) = 0.285 \\ Z_2 &= 1.5/30 (12 - 8.29) = 0.186 \\ Z_3 &= 0.5/10 (12 - 8.29) = 0.086 \\ Z_4 &= 2/40 (10 - 8.29) = 0.086 \\ &= \sum_{i=1}^n +0.285 + 0.186 + 0.186 + 0.086 \\ &= .743 \end{aligned}$$

$$\begin{aligned} X_1 &= 0.285/0.743 = 0.38 \\ X_2 &= 0.186/0.743 = 0.25 \\ X_3 &= 0.186/0.743 = 0.25 \\ X_4 &= 0.086/0.743 = 0.12 \end{aligned}$$

Thus, the proportions to be invested in different securities are obtained. The largest investment should be made in security 1 and the smallest in security 4.

Optimum Portfolio with Short Sales

The procedure used to calculate the optimal portfolio when short sales are allowed is, more or less similar to the procedure adopted for no short sales, except the cut-off point concept. At first, the stocks have to be ranked by excess return to beta. Here, all the stocks are added to the portfolio. They are either held long or short. All the stocks affect the cut-off point. The Z value has to be calculated for each stock. If the Z value is positive, the stock will be held long and if negative, it will be sold short. Stocks which are having

excess return to beta above C^* are held long as in the case of the portfolio without short sales. Stocks with an excess return to beta below C^* are sold short. In the case of previous example $C^* = C = 7.9$, if short sales are permitted, then

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2} \left(\frac{R_i - R_f}{\beta_i} - C^* \right)$$

$$\begin{aligned} Z_1 &= 1/20(14 - 7.9) &= & 0.305 \\ Z_2 &= 1.5/30(12 - 7.9) &= & 0.205 \\ Z_3 &= 0.5/10(12 - 7.9) &= & 0.205 \\ Z_4 &= 2/40(10 - 7.9) &= & 0.105 \\ Z_5 &= 1/20(8 - 7.9) &= & 0.005 \\ Z_6 &= 0.5/50(8 - 7.9) &= & 0.001 \\ Z_7 &= 1.5/30(8 - 7.9) &= & -0.095 \end{aligned}$$

The seventh stock will be sold short.

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2} \left(\frac{R_i - R_f}{\beta_i} - C^* \right)$$

The proportion can be had using:

Summary

- Markowitz developed algorithms to minimise portfolio risk. Diversification reduces the unsystematic risk component of the portfolio.
- The level of risk exposure is measured with the help of the standard deviation of the returns. The expected return is the weighted sum of the expected returns of the portfolio, the weights being the probabilities of their occurrence.
- If securities with less than perfect positive correlation between their price movements are combined risk can be reduced considerably. The risk would be nil or the standard deviation would be zero if two securities have perfect negative correlation. Risk cannot be reduced if the securities

have perfect positive correlation.

- Many portfolios may be attainable. But some portfolios are attractive because they give more return for the same level of risk or same return with lesser level of risk. These portfolios form the efficient frontier.
- Utility curves of the investor decide the most efficient portfolio.
- In the levered portfolio investor is permitted to borrow and lend. Risk free assets are also added with risky assets and it would minimise risk.

Solved Problems

1. Calculate the expected return and variance of a portfolio comprising two securities, assuming that the portfolio weights are 0.75 for security 1 and 0.25 for security 2. The expected return for security 1 is 18 per cent and its standard deviation is 12 per cent, while the expected return and standard deviation for security 2 are 22 per cent and 20 per cent respectively. The correlation between the two securities is 0.6.

Solution

Calculation of expected return of portfolio: $r_p =$

$$\begin{aligned} & \sum x_j r_{j1} \\ &= (0.75 \times 18) + (0.25 \times 22) \\ &= 13.5 + 5.5 = 19 \text{ per cent} \end{aligned}$$

Calculation of portfolio variance:

$$\begin{aligned} \sigma^2 &= x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2 + 2x_1 x_2 (r_{12} \sigma_1 \sigma_2) \\ &= (0.75)^2 (12)^2 + (0.25)^2 (20)^2 + 2(0.75)(0.25)(0.6 \times 12 \times 20) \\ &= 81 + 25 + 54 = 160 \text{ percent} \end{aligned}$$

2. Consider two securities, P and Q, with expected returns of 15 per cent and 24 per cent respectively, and standard deviation of 35 per cent and 52 per cent respectively. Calculate the standard deviation of a portfolio weighted equally between the two securities if their correlation is -0.9.

Solution

Calculation of portfolio standard deviation:

$$\sigma^2 = x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2 + 2x_1 x_2 (r_{12} \sigma_1 \sigma_2)$$

$$= (0.5)^2 (35)^2 + (0.5)^2 (52)^2 + 2 (0.5) (0.5) (-0.9 \times 35 \times 52)$$

$$= 306.25 + 676 - 819 = 163.25$$

$$\sigma = \sqrt{163.25} = 12.78 \text{ percent}$$

3. The historical rates of return of two securities over the past ten years are given. Calculate the covariance and the correlation of the two securities.

Years	11	12	13	14	15	16	17	18	19	10
Security 1 (return percent)	112	18	17	114	116	115	118	220	116	222
Security 2 (return percent)	220	222	224	118	115	220	224	225	222	220

Year	R ₁	Deviation (R ₁ - R ₁)	R ₂	Deviation (R ₂ - R ₂)	Product of deviations
1	12	-2.8	20	-1	2.8
2	8	-6.8	22	1	-6.8
3	7	-7.8	24	3	-23.4
4	14	-0.8	18	-3	2.4
5	16	1.2	15	-6	-7.2
6	15	0.2	20	-1	-0.2
7	18	3.2	24	3	9.6
8	20	5.2	25	4	20.8
9	16	1.2	22	1	1.2

10	22	7.2	20	-1	-7.2
$R = \frac{148}{10} = 14.8$			$R = \frac{210}{10} = 21$		-8.00

Solution

Calculation of Covariance

Year	R_1	R_1^2	R_2	R_2^2
1	12	144	20	400
2	8	64	22	484
3	7	49	24	576
4	14	196	18	324
5	16	256	15	225
6	15	225	20	400
7	18	324	24	576
8	20	400	25	625
9	16	256	22	484
10	22	484	20	400
	148	2398	210	4494

Standard deviation of security 1

$$\begin{aligned}\sigma_1 &= \sqrt{\frac{N\sum R_1^2 - (\sum R_1)^2}{N^2}} \\ &= \sqrt{\frac{(10 \times 2398) - (148)^2}{10 \times 10}} = \sqrt{\frac{23980 - 21904}{100}} \\ &= \sqrt{20.76} = 4.56\end{aligned}$$

Standard deviation of security 2

$$\begin{aligned}\sigma_2 &= \sqrt{\frac{N\sum R_2^2 - (\sum R_2)^2}{N^2}} \\ &= \sqrt{\frac{(10 \times 4494) - (210)^2}{10 \times 10}} \\ &= \sqrt{20.76} = 28.98\end{aligned}$$

Correlation

$$\begin{aligned}r_{12} &= \frac{cov_{12}}{\sigma_1 \sigma_2} \\ &= \frac{-0.8}{4.56 \times 28.98} = \frac{-0.8}{132.15} \\ &= -0.0061\end{aligned}$$

1. A portfolio is constituted with four securities having the following characteristics:

Security	Return (per cent)	Proportion of investment
P	17.5	0.15
Q	24.8	0.25
R	15.7	0.45
S	21.3	0.15

Calculate the expected return of the portfolio.

Solution

Expected return of the portfolio is calculated with the

following formula: $r_p = \sum i^n xiri$

$$= (0.15 \times 17.5) + (0.25 \times 24.8) + (0.45 \times 15.7) + (0.15 \times 21.3)$$

$$= 2.625 + 6.200 + 7.065 + 3.195$$

$$= 19.085 \text{ per cent}$$

2. Given the following variance – covariance matrix for three securities, as well as the percentage of the portfolio that each security comprises, calculate the portfolio’s standard deviation.

Security	A	B	C
A	425	-190	120
B	-190	320	205
C	120	205	175
	W_A = 0.35	W_B = 0.25	W_C = 0.40

Solution

The formula for the calculation of portfolio variance of a portfolio with more than two securities is as follows:

$$\sigma_p^2 = \sum_{i=1}^n w_i^2 \sigma_i^2 + \sum_{i=1}^n \sum_{j=1}^n w_i w_j \sigma_{ij}$$

Variance – Covariance Matrix

Weight	Security	0.35 A	0.25 B	0.40 C
0.35	A	425	-190	120
0.25	B	-190	320	205
0.40	C	120	205	175

$$\begin{aligned} \sigma_p^2 &= (0.35 \times 0.35 \times 425) + (0.35 \times 0.25 \times -190) + (0.35 \times 0.4 \times 120) \\ &\quad + (0.25 \times 0.35 \times -190) + (0.25 \times 0.25 \times 320) + (0.25 \times 0.4 \times 205) \\ &\quad + (0.4 \times 0.35 \times 120) + (0.4 \times 0.25 \times 205) + (0.4 \times 0.4 \times 175) \\ &= 52.06 - 16.63 + 16.8 - 16.63 + 20 + 20.5 + 16.8 + 20.5 + 28 \\ &= 141.40 \end{aligned}$$

The portfolio standard deviation is $\sigma_p =$

$$\sqrt{141.40} = 11.89$$

The estimates of the standard deviations and correlation co-efficient for three stocks are given below:

Stock	Standard deviation	Correlation with stock		
		A	B	C
A	32	1.00	-0.80	0.40
B	26	-0.80	1.00	0.65
C	18	0.40	0.65	1.00

If a portfolio is constructed with 15 per cent of stock A, 50 per cent of stock B and 35 per cent of stock C, what is the portfolio's standard deviation?

Solution

Here, the covariance's between securities are not given. However, the covariance between two securities may be expressed as the product of correlation coefficient between the two securities and standard deviations of the two securities that is,

$$\sigma_{ij} = r_{ij} \sigma_i \sigma_j$$

The variance – covariance matrix may therefore be set up as follows:

Weight	Security	0.15 A	0.50 B	0.35 C
0.15	A	(1 x 32 x 32)	(-0.8 x 32 x 26)	(0.4 x 32 x 18)

0.50	B	(-0.8 x 26 x 32)	(1 x 26 x 26)	(0.65 x 26 x 18)
0.35	C	(0.4 x 18 x 32)	(0.65 x 18 x 26)	(1 x 18 x 18)

The matrix may be simplified as follows:

Weight	Security	0.15 A	0.50 B	0.35 C
0.15	A	1024.0	-665.6	230.4
0.50	B	-665.6	676.0	304.2
0.35	C	230.4	304.2	324.0

$$\begin{aligned}
 \sigma_p^2 &= (0.15 \times 0.15 \times 1024.0) + (0.15 \times 0.5 \times -665.6) + (0.15 \times 0.35 \times 230.4) \\
 &\quad + (0.5 \times 0.15 \times -665.6) + (0.5 \times 0.5 \times 676.0) + (0.5 \times 0.35 \times 304.2) \\
 &\quad + (0.35 \times 0.15 \times 230.4) + (0.35 \times 0.5 \times 304.2) + (0.35 \times 0.35 \times 324) \\
 &= 23.04 - 49.92 + 12.10 - 49.92 + 169 + 53.24 + 12.10 + 53.24 + 36.69 \\
 &= 262.57
 \end{aligned}$$

The portfolio standard deviation is $\sigma_p =$

$$\sqrt{262.57} = 16.20$$

6. An investor owns a portfolio whose market model is estimated as:

$$R_p = 2.3 + 0.85 R_m + e_p$$

If the expected return on the market index is 17.5 per cent, what is the expected return on the investor's portfolio?

Solution

Assuming that $e_p = 0$

$$\begin{aligned} R_p &= 2.3 + 0.85 (17.5) \\ &= 2.3 + 14.875 \\ &= 17.175 \text{ per cent} \end{aligned}$$

An investor owns a portfolio composed of five securities with the following characteristics:

Security	Beta	Random error term standard deviation (per cent)	Proportion
1	1.35	5	0.10
2	1.05	9	0.20
3	0.80	4	0.15
4	1.50	12	0.30
5	1.12	8	0.25

If the standard deviation of the market index is 20 per cent, what is the total risk of the portfolio?

Solution

The total portfolio risk may be expressed as:

$$\sigma_p^2 = \beta_p^2 \sigma_m^2 + \sum_{i=1}^n w_i^2 \sigma_{e_i}^2$$

where

β_p^2 = Portfolio beta.

σ_m^2 = Variance of the market index.

w_i^2 = Proportion of investment in each security.

$\sigma_{e_i}^2$ = Residual variance (random error) of individual securities.

β_p or portfolio beta has to be calculated using the formula.

$$\begin{aligned} \beta_p &= \sum w_i \beta_i \\ &= (0.1)(1.35) + (0.2)(1.05) + (0.15)(0.80) + (0.3)(1.5) + (0.25)(1.12) \\ &= 1.195 \end{aligned}$$

Portfolio residual variance ($\sum w_i^2 \sigma_{e_i}^2$) can be calculated as:

$$\begin{aligned} &= (0.1)^2(5)^2 + (0.2)^2(9)^2 + (0.15)^2(4)^2 + (0.3)^2(12)^2 + (0.25)^2(8)^2 \\ &= 20.81 \end{aligned}$$

Portfolio total risk can now be calculated as

$$\begin{aligned} \sigma_p^2 &= \beta_p^2 \sigma_m^2 + \sum w_i^2 \sigma_{e_i}^2 \\ &= (1.195)^2(20)^2 + 20.81 \\ &= 571.21 + 20.81 = 592.02 \end{aligned}$$

1. Consider a portfolio composed of five securities. All the securities have a beta of 1.0 and unique or specific risk (standard deviation) of 25 per cent. The portfolio distributes weight equally among its component securities. If the standard deviation of the market index is 18 per cent, calculate the total risk of the portfolio.

Solution

The input data may be arranged in the form of the following table

Security	Beta	Specific risk (Standard deviation)	Proportion
1	1.0	25	0.2
2	1.0	25	0.2
3	1.0	25	0.2
4	1.0	25	0.2
5	1.0	25	0.2

Standard deviation of market index is 18 per cent.

$$\beta_p = \sum_{i=1}^n w_i \beta_i$$

$$= (0.2 \times 1.0) \times 5 = 1.0$$

Portfolio residual variance =

$$= (0.2)^2 (25)^2 \times 5 = 125$$

Portfolio total risk

$$\sigma_p^2 = \beta_p^2 \sigma_m^2 + \sum_{i=1}^n w_i^2 \sigma_{e_i}^2$$

$$= (1.0)^2 (18)^2 + 125$$

$$= 324 + 125 = 449$$

2. How many parameters must be estimated to analyse the risk- return profile of a 50-stock portfolio using (a) the original Markowitz model, and (b) the Sharpe single index model?

Solution

In Markowitz model we require the following estimates: N return estimates

N variance estimates

N (N-1)/2 covariance estimates Total estimates = 2N + [N (N-1)/2]

$$= (2 \times 50) + [50 (50 - 1)/2]$$

$$= 100 + 1225 = 1325$$

In the Sharpe single index model we must have

N α estimates

N β estimates

N residual variance estimates.

Market return, R_m

Variance of market return, σ_m^2

Total estimates = 3N + 2

$$= (3 \times 50) + 2 = 152$$

Consider a portfolio of four securities with the following characteristics:

Security	Weighting g	α_i	β_i	Residual variance (σ^2) e_i
1	0.2	2.0	1.2	320
2	0.3	1.7	0.8	450
3	0.1	-0.8	1.6	270
4	0.4	1.2	1.3	180

Calculate the return and risk of the portfolio under single index model, if the return on market index is 16.4 per cent and the standard deviation of return on market index is 14 per cent.

Solution

1. Portfolio return under single index model is calculated using the formula: $R_p = \alpha_p + \beta_p R_m$ For applying this formula, α_p , and β_p have to be calculated as:

$$\alpha_p = \sum_{i=1}^n w_i \alpha_i$$

$$(0.2)(2.0) + (0.3)(1.7) + (0.1)(-0.8) + (0.4)(1.2)$$

$$= 1.31$$

$$\beta_p = \sum_{i=1}^n w_i \beta_i$$

$$= (0.2)(1.2) + (0.3)(0.8) + (0.1)(1.6) + (0.4)(1.3)$$

$$= 1.16$$

$$R_p = \alpha_p + \beta_p R_m$$

$$= 1.31 + (1.16)(16.4)$$

$$= 1.31 + 19.024$$

$$= 20.334$$

2. Portfolio risk under single index model is calculated as:

$$\sigma_p^2 = \beta_p^2 \sigma_{R_m}^2 + \sum_{i=1}^n w_i^2 \sigma_{e_i}^2$$

For applying this, portfolio residual variance needs to be calculated as:

$$\hat{\sigma}_{\epsilon}^2 = \sum_{i=1}^n w_i^2 \sigma_{\epsilon_i}^2$$

Thus,

3. Portfolio risk under single index model is calculated as:

$$\sigma_p^2 = \beta_p^2 \sigma_m^2 + \sum_{i=1}^n w_i^2 \sigma_{\epsilon_i}^2$$

For applying this, portfolio residual variance needs to be calculated as:

$$\hat{\sigma}_{\epsilon}^2 = \sum_{i=1}^n w_i^2 \sigma_{\epsilon_i}^2$$

$$\hat{\sigma}_{\epsilon}^2 = \sum_{i=1}^n w_i^2 \sigma_{\epsilon_i}^2$$

Thus,

$$\begin{aligned} & (0.2)^2(320) + (0.3)^2(450) + (0.1)^2(270) + (0.4)^2(180) \\ & = 12.8 + 40.5 + 2.7 + 28.8 \\ & = 84.8 \end{aligned}$$

$$\sigma_p^2 = \sum_{i=1}^n w_i^2 \sigma_i^2$$

Now,

$$\begin{aligned} \sigma_p^2 &= \beta^2 \sigma^2 \\ &= (1.16)^2 (14)^2 + 84.8 \\ &= 263.74 + 84.8 = 348.54 \end{aligned}$$

Hence,

$$\sigma_p = \sqrt{348.54} = 18.67$$

4. The data for three stocks are given. The data are obtained from correlating returns on these stocks with the returns on the market index.

Stock	α_i	β_i	Residual variance (percent) (σ^2) <i>ei</i>
1	-2.1	1.6	14
2	1.8	0.4	8
3	1.2	1.3	18

Which single stock would an investor prefer to own from a risk-return view point if the market index were expected to have a return of 15 per cent and a variance of return of 20 per cent?

Solution

Here we have to calculate the expected return and risk of each security under the single index model.

Expected return $R_i = \alpha_i + \beta_i R_m$

Security 1 $= -2.1 + (1.6)(15) = -2.1 + 24 = 21.9$

Security 2 $1.8 + (0.4)(15) = 1.8 + 6 = 7.8$

Security 3 $= 1.2 + (1.3)(15) = 1.2 + 19.5 = 20.7$

Security risk

$$\sigma^2 = \beta^2 \sigma^2 + \sigma^2$$

$\sigma^2 = \beta^2 \sigma^2 + \sigma^2$

Security 1 $= (1.6)^2(20) + 14 = 51.2 + 14 = 65.2$

Security 2 $= (0.4)^2(20) + 8 = 3.2 + 8 = 11.2$

Security 3 $= (1.3)^2(20) + 18 = 33.8 + 18 = 51.8$

Now we can calculate the ratio of return to risk to assess the return per unit of risk.

$$\text{Security 1} = \frac{21.9}{65.2} = 0.34$$

$$\text{Security 2} = \frac{7.8}{11.2} = 0.70$$

$$\text{Security 3} = \frac{20.7}{51.8} = 0.40$$

Self Assessment Questions

1. Explain the concept and process of portfolio analysis?
2. Explain the significance of covariance in the estimation of the risk of a portfolio?
3. Define the Markowitz diversifications explain the statistical method used by Markowitz to obtain the risk reducing benefit?
4. How do the utility curves differ for risk loving neutral and averse investors?
5. What are the simple diversification (a) will it reduce total risk (b) will it reduce unsystematic risk?
6. Explain the Sharpe index model? How does it differ from the

Markowitz model?

7. What are the steps in the traditional approach?
8. How do you arrive the optimum portfolio?
9. Explain the constraints in the formation of objectives?
10. What happens to the risk of a portfolio as more and more securities are added to the portfolio?

CASE STUDY

Mr.X will retire at the end of 10 years. Upon retirement he is entitled to receive an annual end of year payment of ` 1,20,000 for 15 years. If he does prior to the end of the 15 years period, his heirs would be entitled to the contractual payment.

His employers, Reliance Industries Ltd. Has to accumulate funds to provide a retirement annuity by making an equal annual year-end deposited into an accounting earning 7% interest. When the 15-year payment period begins the company would transfer the accumulated fund into an account earning a granted 9% at the end of the company period, the account balance would be zero required.

- (a) How much would the company accumulate by the end of the year?
- (b) What should be the company's equal annual end-of-year deposit into the account be over the 10 years. Period to fund fully the retirement annually?

Capital Asset Pricing Theory

Introduction

Investors are interested in knowing the systematic risk when they search for efficient portfolios. They would like to have assets with low beta co-efficient i.e. systematic risk. Investors would opt for high beta co-efficient only if they provide high rates of return. The risk averse nature of the investors is the underlying factor for this behavior. The capital asset pricing theory helps the investors to understand the risk and return relationship of the securities. It also explains how assets should be priced in the capital market.

The CAPM Theory

Markowitz, William Sharpe, John Lintner and Jan Mossin provided the basic structure for the CAPM model. It is a model of linear general equilibrium return. In the CAPM theory, the required rate return of an asset is having a linear relationship

with asset's beta value i.e. undiversifiable or systematic risk.

Assumptions

1. An individual seller or buyer cannot affect the price of a stock. This assumption is the basic assumption of the perfectly competitive market.
2. Investors make their decisions only on the basis of the expected returns, standard deviations and co variances of all pairs of securities.
3. Investors are assumed to have homogenous expectations during the decision-making period.
4. The investor can lend or borrow any amount of funds at the riskless rate of interest. The riskless rate of interest is the rate of interest offered for the treasury bills or Government securities.
5. Assets are infinitely divisible. According to this assumption, investor could buy any quantity of share i.e. they can even buy ten rupees worth of Reliance Industry shares.
6. There is no transaction cost i.e. no cost involved in buying and selling of stocks.
7. There is no personal income tax. Hence, the investor is indifferent to the form of return either capital gain or dividend.
8. Unlimited quantum of short sales is allowed. Any amount of shares an individual can sell short.

Lending and Borrowing

Here, it is assumed that the investor could borrow or lend any amount money at riskless rate of interest. When this opportunity is given to the investors, they can mix risk free assets with the risky assets in a portfolio to obtain a desired rate of risk-return combination.

R_p = Portfolio return

X_f = the proportion of funds invested in risk free assets

$1 - X_f$ = the proportion of funds invested in risky assets

R_f = Risk free rate of return

R_m = Return on risky assets

The expected return on the combination of risky and risk free combination is R_p

$$= R_f X_f + R_m(1 - X_f)$$

This formula can be used to calculate the expected returns for different situations, like mixing risk free assets with risky assets, investing only in the risky asset and mixing the borrowing with risky assets.

Now, let us assume that borrowing and lending rate to be 12.5% and the return from the risky assets to be 20%. There is a trade off between the expected return and risk. If an investor invests in risk free assets and risky assets, his risk may be less than what he invests in the risky asset alone. But if he borrows to invest in risky assets, his risk would increase more than he invests his own money in the risky assets. When he borrows to invest, we call it financial leverage. If he invests 50% in risk free assets and 50% in risky assets, his expected return of the portfolio would be

$$\begin{aligned} R_p &= R_f X_f + R_m(1 - X_f) \\ &= 12.5 \times .5 + 20(1 - .5) \\ &= 6.25 + 10 \\ &= 16.25\% \end{aligned}$$

If there is a zero investment in risk free asset and 100% in risky asset, the return is

$$\begin{aligned} R_b &= R_f X_f + R_m(1 - X_f) \\ &= 0 + 20\% \\ &= 20\% \end{aligned}$$

If - .5 in risk free asset and 1.5 in risky asset, the return is

$$\begin{aligned} R_b &= R_f X_f + R_m(1 - X_f) \\ &= (12.5 \times -.5) + 20 \times 1.5 \\ &= -6.25 + 30 \\ &= 23.75 \end{aligned}$$

The variance of the above mentioned portfolio can be calculated by using the equation.

$$\sigma_p^2 = \sigma_f^2 X_f^2 + \sigma_{(1-X_f)}^2 + 2\text{Cov}_{X_f}(1-X_f)$$

The previous example can be taken for the calculation of the variance. The variance of the risk free asset is in. The variance of the risky asset is assumed to be 15. Since the variance of the risky asset is zero, the 1,rtfolio risk solely depends on the portion of investment on risky asset.

Proportion in risky asset (1- X _f)	Portfolio risk
0.5	1.0
1.5	7.5
1.5	22.5

The risk is more in the borrowing portfolio being 22.5% and the return is also high among the three alternatives. In the lending portfolio, the risk is 7.5% and the return is also the lowest. The risk premium is proportional to risk, where the risk premium of a portfolio is defined as the difference between R_p - R_f i.e. the amount by which a risky rate of return exceeds the riskless rate of return.

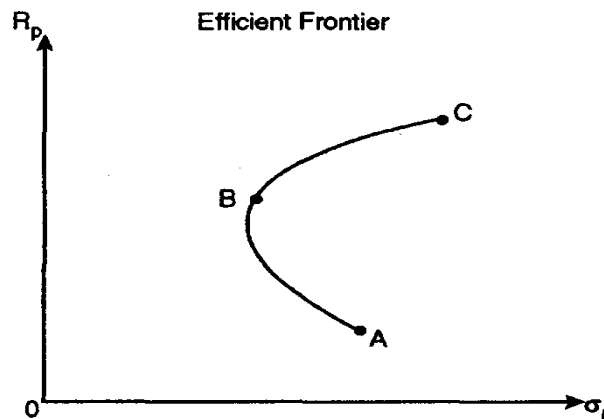
Risk - Return Trade Off

Portfolio Return R _p	Risk- free Return R _f	Risk Premiu m R _p - R _f	Portfoli o Risk σ	Factor of Proportionalit y (R _p - R _f)/σ _p
16.25	12.5	3.75	7.5	0.5
20.0	12.5	7.5	15.0	0.5
23.75	12.5	11.25	22.5	0.5

The risk-return proportionality ratio is a constant .5, indicating that one unit of risk premium is accompanied by 0.5 unit of risk.

The Concept

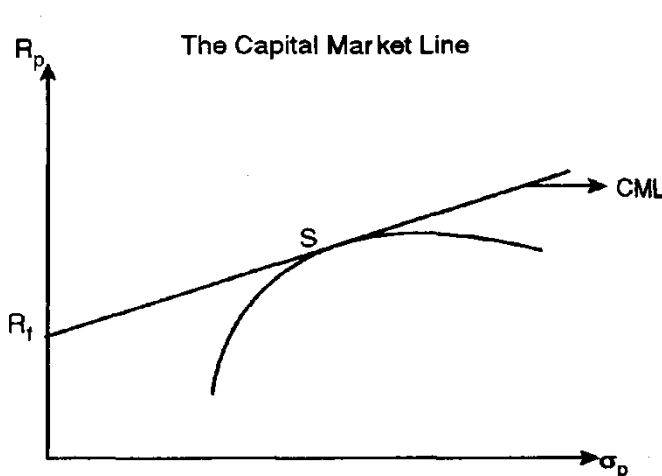
According to CAPM, all investors hold only the market portfolio and riskless securities. The market portfolio is a portfolio comprised of all stocks in the market. Each asset is held in proportion to its market value to the total value of all risky assets. For example, if Reliance Industry share represents 20% of all risky assets, then the market portfolio of the individual investor contains 20% of Reliance industry shares. At this stage, the investor has the ability to borrow or lend any amount of money at the riskiness rate of interest. The efficient frontier of the investor is given in figure.



The figure shows the efficient frontier of the investor. The investor prefers any point between B and C because, with the same level of risk they face on line BA, they are able to get superior profits. The ABC line shows the investor's portfolio of risky assets. The investors can combine riskless asset either by lending or borrowing. This is shown in Figure. The line R_fS represents all possible combination of riskless and risky asset. The 'S' portfolio does not represent any riskless asset but the line RS gives the combination of both. The portfolio along the path RS is called lending portfolio that is some money is invested in the riskless asset or may be deposited in the bank for a fixed rate of interest. If it crosses the point S. it becomes borrowing portfolio. Money is borrowed and invested in the risky asset. The straight line is called capital market line (CML). It gives the desirable set of investment opportunities between risk free and risky

investments. The CML represents linear relationship between the required rates of return for efficient portfolios and their standard deviations.

$E(R_p)$ = portfolio's
 expected rate of return
 R_m = expected return on
 market portfolio
 σ_m = standard deviation of
 market portfolio σ_p =
 standard deviation of the
 portfolio



For a portfolio on the capital market line, the expected rate of return in excess of the risk-free rate is in proportion to the standard deviation of the market portfolio. The price of the risk is given by the slope of the line. The slope equals the premium for the market portfolio $R_m - R_f$ divided by the risk or standard deviation of the market portfolio. Thus, the expected return of an efficient portfolio is

Expected return = Price of time + (Price of risk. Amount of risk)

Price of time is the risk-free rate of return. Price of risk is the premium amount higher and above the risk-free return.

Security Market Line

The risk-return relationship of an efficient portfolio is measured by the capital market line. But, it does not show the risk-return tradeoff for other portfolios and individual securities. Inefficient portfolios lie below the capital market line and the risk-return relationship cannot be established with the help of the capital market line. Standard deviation includes the systematic and unsystematic risk. Unsystematic risk can be diversified and it is not related to the market. If the unsystematic risk is eliminated, then the matter of concern is systematic risk alone. This systematic risk could be measured by beta. The beta analysis is useful for individual securities and portfolios whether efficient or inefficient. When an additional security is added to the market portfolio, an additional risk is also added to it. The variance of a portfolio is equal to the weighted sum of the co-variances of the individual securities in the portfolio. If we add an additional security to the market portfolio, its marginal contribution to the variance of the market is the covariance between the security's return and market portfolio's return. If the security i is included, the covariance between the security and the market measures the risk. Covariance can be standardized by dividing it by standard deviation of market portfolio $\text{Cov } i_m / \sigma_m$. This shows the systematic risk of the security. Then, the expected return of the security i is given by the equation:

$$R_i - R_f = (R_m - R_f / \sigma_m) \text{Cov } i_m / \sigma_m$$

This equation can be rewritten as follows $R_i -$

$$R_f = \text{Cov } i_m / \sigma_m^2 (R_m - R_f)$$

The first term of the equation is nothing but the beta coefficient of the stock. The beta coefficient of the equation of SML is same as the beta of the market (single index) model. In equilibrium, all efficient and inefficient portfolios lie along the security market line. The SML line helps to determine the expected return for a given security beta. In other words, when betas are given, we can generate

expected returns for the given securities. This is explained in fig. If we assume the expected market risk premium to be 8% and the risk free rate of return tube 7%, we can calculate expected return for A, B, C and D securities using the formula

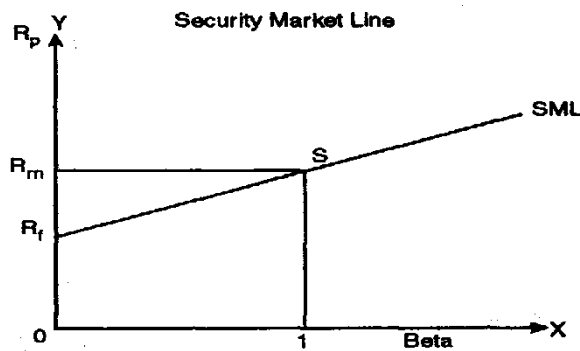
$$E(R_i) = R_f + \beta_i [E(R_m) - R_f]$$

If beta for $\beta = 1$

If beta for = 1

$$= 7 + 1(8)$$

$$= 15\%$$



Security A

$$\text{Beta} = 1.10$$

$$E(R) = 7 + 1.10(8)$$

$$= 15.8$$

Security B

$$\text{Beta} = 1.20$$

$$E(R) = 7 + 1.20(8)$$

Security C

$$\text{Beta} = .7$$

$$E(R) = 7 + .7(8)$$

$$= 12.6$$

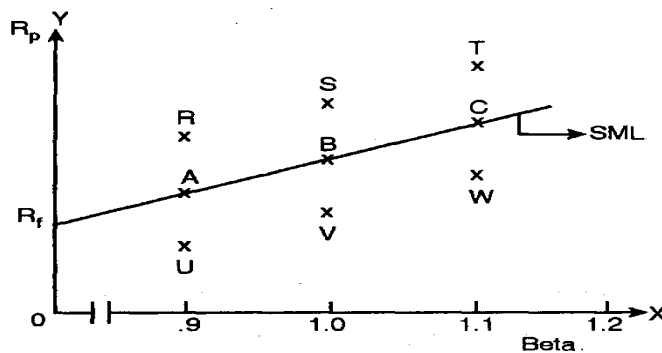
The same can be found out easily from the figure too. All we have to do is, to

mark the beta on the horizontal axis and draw a vertical line from the relevant point to touch the SML line. Then from the point of intersection, draw another horizontal line to touch the Y axis. The expected return could be very easily read from the Y axis. The securities A and B are aggressive securities, because their beta values are greater than one. When beta values are less than one, they are known as defensive securities. In our example, security C has the beta value less than one.

Evaluation of Securities

Relative attractiveness of the security can be found out with the help of security market line. Stocks with high risk factor are expected to yield more return and vice-versa. But the investor would be interested in knowing whether the security is offering return more or less proportional to its risk.

Evaluation of Securities with SML



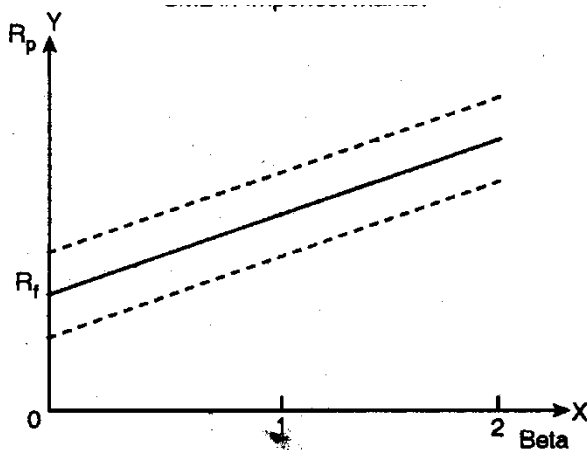
The figure provides an explanation for the evaluation. There are nine points in the diagram. A, B and C lie on the security market line, R, S and T above the SML and U, V and W below the SML. ARU have the same beta level of, 9. Likewise beta values of SBV = 1.00 and TCW = 1.10. The stocks above the SML yield higher returns for the same level of risk. They are underpriced compared to their beta value. With the simple rate of return formula, we can prove that they are undervalued. P_1 is the present price P_0 - the purchase price and Div - Dividend. When the purchase price is low i.e. when the denominator value is low, the expected return could be high. Applying the same principle the stocks U, V and W can be classified as overvalued securities and are expected to yield lower returns than stocks of comparable risk. The denominator value

may be high i.e. the purchase price may be high. The prices of these scripts may fall and lower the denominator. There by, they may increase the returns on securities. The securities A, B and C are on the line. Therefore, considered to be appropriately valued. They offer returns in proportion to their risk. They have average 40clc performance, since they are neither undervalued nor overvalued.

Market Imperfection and SML

Information regarding the share price an4 market condition may not be immediately available to all investors. Imperfect information may affect the valuation of securities. In a market with perfect information, all securities should lie on SML. Market imperfections would lead to a band of SML rather than a single line. Market imperfections affect the width of the SML to a band. If imperfections are more, the width also would be larger. SML in imperfect market is given in figure.

SML in Imperfect Market



Empirical Tests of the CAPM

In the CAPM, beta is used to estimate le systematic of the security and reflects the future volatility of the stock in relation to the market. Future volatility of the stock is estimated only through historical data. Historical data are used to plot the regression line or the characteristic line and calculate beta. If historical betas are stable over a period of time, they would be good proxy for

their ex-ante or expected risk.

Robert A. Levy, Marshall B. Blume and others have studied the question of beta stability in depth. I calculated betas for both Individual securities and portfolios. His study results have provided the following conclusions

- (1) The betas of individual stocks are unstable; hence the past betas for the individual securities are not good estimators of future risk.
- (2) The betas of portfolios of ten or more randomly selected stocks are reasonably stable, hence the portfolio betas are good estimators of future portfolio volatility. This is because of the errors in the estimates of individual securities' betas tend to offset one another in a portfolio.

Various researchers have attempted to find out the validity of the model by calculating beta and realized rate of return. They attempted to test (1) whether the intercept is equal to i.e. risk free rate of interest or the interest rate offered for treasury bills (2) whether the line is linear and pass through the $\beta = 1$ being the required rate of return of the market. In general, the studies have showed the following results.

- (1) The studies generally showed a significant positive relationship between the expected return and t systematic risk. But the slope of the relationship is usually less than that of predicted by the CAPM.
- (2) The risk and return relationship appears to be linear. Empirical studies give no evidence of significant curvature in the risk/return relationship,.
- (3) The attempts of the researchers to assess the relative importance of the market and company risk have yielded definite results. The CAPM theory implies that unsystematic risk is not relevant, but unsystematic and systematic risks are positively related to security returns. Higher returns are needed to compensate both the risks. Most of the observed relationship reflects statistical problems rather than the true nature of capital market.

- (4) According to Richard Roll, the ambiguity of the market portfolio leaves the CAPM untestable. The practice of using indices as proxies is loaded with problems. Different indices yield different betas for the same security.
- (5) If the CAPM were completely valid, it should apply to all financial assets including bonds. But, when bonds are introduced into the analysis, they do not fall on the security market line.

Present Validity of CAPM

The CAPM is greatly appealing at an intellectual level, logical and rational. The basic assumptions on which the model is built raise some doubts in the minds of the investors. Yet, investment analysts have been more creative in adapting CAPM for their uses.

- (1) The CAPM focuses on the market risk, makes the investors to think about the riskiness of the assets in general. CAPM provides basic concepts which are truly of fundamental value.
- (2) The CAPM has been useful in the selection of securities and portfolios. Securities with higher returns are considered to be undervalued and attractive for buy. The below normal expected return yielding securities are considered to be overvalued and suitable for sale.
- (3) In the CAPM, it has been assumed that investors consider only the market risk. Given the estimate of the risk free rate, the beta of the firm, stock and the required market rate of return, one can find out the expected returns for a firm's security. This expected return can be used as an estimate of the cost of retained earnings.
- (4) Even though CAPM has been regarded as a useful tool to financial analysts, it has its own critics too. They point out, when the model is ex-ante, the inputs also should be ex-ante, i.e. based on the expectations of the future. Empirical tests and analyses have used ex-post i.e. past data only.
- (5) The historical data regarding the market return, risk free rate of

return and betas vary differently for different periods. The various methods used to estimate these inputs also affect the beta value. Since the inputs cannot be estimated precisely, the expected return found out through the CAPM model is also subjected to criticism 4

Arbitrage Pricing Theory

Arbitrage pricing theory is one of the tools used by the investors and portfolio managers. The capital asset pricing theory explains the return of the securities on the basis of their respective betas. According to the previous models, the investor chooses the investment on the basis of expected return and variance. The alternative model developed in asset pricing by Stephen Ross is known as Arbitrage Pricing Theory. The APT theory explains the nature of equilibrium in the asset pricing in a less complicated manner with fewer assumptions compared to CAPM.

Arbitrage

Arbitrage is a process of earning profit by taking advantage of differential pricing for the same asset. The process generates riskless profit. In the security market, it is of selling security at a high price and the simultaneous purchase of the same security at a relatively lower price. Since the profit earned through arbitrage is riskless, the investors have the incentive to undertake this whenever an opportunity arises. In general, some investors indulge more in this type of activities than others. However, the buying and selling activities of the arbitrageur reduce and eliminate the profit margin, bringing the market price to the equilibrium level.

The Assumptions

1. The investors have homogenous expectations.
2. The investors are risk averse and utility maximisers.
3. Perfect competition prevails in the market and there is no transaction cost.

The APT theory does not assume (1) single period investment horizon, (2) no taxes (3) investors can borrow and lend at risk free rate of interest and (4) the selection of the portfolio is based on the mean and variance analysis. These assumptions are present in the CAPM theory.

Arbitrage Portfolio

According to the APT theory an investor tries to find out the possibility to increase returns from his portfolio without increasing the funds in the portfolio. He also likes to keep the risk at the same level. For example, the investor holds A, B and C securities and he wants to change the proportion of the securities without any additional financial commitment. Now the change in proportion of securities can be denoted by ΔX_A , ΔX_B , and ΔX_C . The increase in the investment in security A could be carried out only if he reduces the proportion of investment either in B or C because it has already stated that the investor tries to earn more income without increasing his financial commitment. Thus, the changes in different securities will add up to zero. This is the basic requirement of an arbitrage portfolio. If X indicates the change in proportion,

$$\Delta X_A + \Delta X_B + \Delta X_C = 0$$

The factor sensitivity indicates the responsiveness of a security's return to a particular factor. The sensitiveness of the securities to any factor is the weighted average of the sensitivities of the securities, weights being the changes made in the proportion. For example, b_A , b_B and b_C are the sensitivities, in an arbitrage portfolio the sensitivities become zero. The investor holds the A, B and C stocks with the following returns and sensitivity to changes in the industrial production. The total amount invested is ₹ 1,50,000.

I	R	b	Original weights
Stock A	20%	.45	.33
Stock B	15%	1.35	.33
Stock C	12%	.55	.34

Now the proportions are changed.

The changes are

$$\Delta X_A = .02$$

$$\Delta X_B =$$

$$.025$$

$$\Delta X_C = -.225$$

For an arbitrage portfolio

$$\Delta X_A + \Delta X_B + \Delta X_C = 0$$

$$.2 + .025 - .225 = 0$$

The sensitivities also become zero

$$\Delta X_A b_A + \Delta X_B b_B + \Delta X_C b_C = 0$$

$$.2 \times .45 + .025 \times 1.35 - .225 \times .55 = 0$$

In an arbitrage portfolio, the expected return should be greater than zero.

$$\Delta X_A R_A + \Delta X_B R_B + \Delta X_C R_C > 0$$

$$.2 \times 20 + .025 \times 15 - .225 \times 12$$

$$4.375 - 2.7 > 0$$

$$\text{i.e. } 1.675\%$$

The investor would increase his investment in stock A and B by selling C. The new compositions of weights are

$$X_A = 0.53$$

$$X_B = 0.355$$

$$X_c = 0.115$$

The portfolio allocation on stocks A, B and C is as follows

$$= 1,50,000 \times .53 + 1,50,000 \times .355 + 1,50,000 \times .115$$

$$= 79,500 + 53250 + 17250$$

The sensitivity of the new portfolio will be

$$= .45 \times .53 + 1.35 \times .355 + .55 \times .115$$

$$= .239 + .479 + .063 = .781$$

This is same as the old portfolio sensitivity

$$\text{i.e. } .45 \times .33 + 1.35 \times .33 + .55 \times .34 = .781$$

The return of the new portfolio is higher than the old portfolio. Old portfolio return

$$= 20 \times .33 + 15 \times .33 + 12 \times .34$$

$$= 6.6 + 4.95 + 4.08$$

$$= 15.63\%$$

The new portfolio return

$$= 20 \times .53 + 15 \times .355 + 12 \times .115$$

$$= 10.6 + 5.325 + 1.38$$

$$= 17.305\%$$

This is equivalent to the old portfolio return plus the return that occurred due to the change in portfolio

$$= 15.63\% + 1.675\% = 17.305\%$$

The variance of the new portfolio's change is only due to the changes in its non-factor risk. Hence, the change in the risk factor is negligible. From the analysis it can be concluded that

1. The return in the arbitrage portfolio is higher than the old portfolio.
2. The arbitrage and old portfolio sensitivity remains the same.
3. The non-factor risk is small enough to be ignored in an arbitrage portfolio.

Effect on Price

To buy stock A and B the investor has to sell stock C. The buying pressure on stock A and B would lead to increase in their prices. Conversely selling of stock C will result in fall in the price of the stock C. With the low price there would be rise in the expected return of stock C. For example, if the stock "C" at price ` 100 per share have earned 12 percent return, at ` 80 per share the return would be $12/80 \times 100 = 15\%$. At the same time, return rates would be declining in stock A and B with the rise in price. This buying and selling activity will continue until all arbitrage possibilities are eliminated. At this juncture, there exists an approximate linear relationship between expected returns and sensitivities.

The APT Model

According to Stephen Ross, returns of the securities are influenced by a number of macro economic factors. The macro economic factors are growth rate of industrial production, rate of inflation, spread between long term and short term interest rates and spread between low-grade and high grade bonds. The arbitrage theory is represented by the equation:

$$R_i = \lambda_0 + \lambda_1 b_{i1} + \lambda_2 b_{i2} + \dots +$$

$$\lambda_j b_{ij} \quad R_i = \text{average expected return}$$

$$\lambda_1 = \text{sensitivity of return to } b_{i1}$$

$$b_{i1} = \text{the beta co-efficient relevant to the particular factor.}$$

The equation is derived from the model

$$R_i = \alpha_1 + b_{i1} I_1 + b_{i2} I_2 \dots + b_{ij} I_j + e_i$$

Let us take the two-factor model

$$R_i = \lambda_0 + \lambda_1 b_{i1} + \lambda_2 b_{i2} + b_{i2}$$

If the portfolio is a well-diversified one, unsystematic risk tends to be zero and systematic risk is represented by b_{i1} and b_{i2} in the equation. Let us assume the existence of three well diversified portfolios as shown in the table.

Portfolio	Expected return	b_{i1}	b_{i2}
A	12.0	1	0.5
B	13.4	3	0.2
C	12	3	-0.5

The equation $R_i = \lambda_0 + \lambda_1 b_{i1} + \lambda_2 b_{i2} + b_i$ can be determined with the help of the above-mentioned details. By solving the following equations

$$12 = \lambda_0 + 1\lambda_1 + 0.5\lambda_2$$

$$13.4 = \lambda_0 + 3\lambda_1 + 0.2\lambda_2$$

$$12 = \lambda_0 + 3\lambda_1 - 0.5\lambda_2$$

Thus λ_1 is the expected excess return over the risk-free rate of return for a portfolio with unit sensitivity to the factor. The excess return is known as risk premium.

Factors Affecting the Return

The specification of the factors is carried out by many financial analysts. Chen, Roll and Ross have taken four macro-economic variables and tested them. According to them the factors are inflation, the term structure of interest rates, risk premium and industrial production. Inflation affects the discount rate or the required rate of return and the size of the future cash flows. The short-term inflation is measured by monthly percentage changes in the consumer price index. The interest rates on long term bonds and short-term bonds differ. This difference affects the value of payments in future relative to short term payments. The difference between the return on the high-grade bonds and low grade (riskier) bonds indicates the market's reaction to risk. The industrial production represents the business cycle. Changes in the industrial production have an impact on the expectations and opportunities of the investor.

The real value of the cash flow is also affected by it. Burmeister and McElroy have estimated the sensitivities with some other factors.

They are given below

- Default risk
- Time premium
- Deflation
- Change in expected sales
- The market returns not due to the first four variables.

The default risk is measured by the difference between the return on long term government bonds and the return on long terms bonds issued by corporate plus one-half of one per cent. Lime premium is measured by the return on long term government bonds minus one month Treasury bill rate one month ahead. Deflation is measured by expected inflation at the beginning of the month minus actual inflation during the month. According to then, the first four factors accounted 25% of the variation in the Standard and 1or Composite Index and all the four co-efficient were significant. Salomon Brothers identified five factors in their fundamental factor model. Inflation is the only common factor identified by others. The other factors are given below

- Growth rate in gross national product
- Rate of interest
- Rate of change in oil prices
- Rate of change in defence spending

All the three sets of factors have some common characteristics. They all affect the macro-economic activities. Inflation and interest rate are identified as common factors. Thus, the stock price is related to aggregate economic activity and the discount rate of future cash flow

APT and CAPM

The simplest form of APT model is consistent with the simple form of the CAPM model. When only one factor is taken into consideration, the APT can be stated as:

$$R_i = \lambda_0 + b_i \lambda_1$$

It is similar to the capital
market line equation

$$R = R_f + \beta (R_m - R_f)$$

Which is similar to the CAPM model?

APT is more general and less restrictive than CAPM. In APT, the investor has no need to hold the market portfolio because it does not make use of the market portfolio concept. The portfolios are constructed on the basis of the factors to eliminate arbitrage profits. APT is based on the law of one price to hold for all possible portfolio combinations. The APT model takes into account of the impact of numerous factors on the security. The macro-economic factors are taken into consideration and it is closer to reality than CAPM.

The market portfolio is well defined conceptually. In APT model, factors are not well specified. Hence the investor finds it difficult to establish equilibrium relationship. The well-defined market portfolio is a significant advantage of the CAPM leading to the wide usage of the model in the stock market. The factors that have impact on one group of securities may not affect another group of securities. There is a lack of consistency in the measurements of the APT model. Further, the influences of the factors are not independent of each other. It may be difficult to identify the influence that corresponds exactly to each factor. Apart from this, not all variables that exert influence on a factor are measurable.

Portfolio Evaluation

Portfolio manager evaluates his portfolio performance and identifies the sources of strength and weakness. The evaluation of the portfolio provides a feed back about the performance to evolve better management strategy. Even though evaluation of portfolio performance is considered to be the last stage of investment process, it is a continuous process. The managed portfolios are commonly known as mutual funds. Various managed portfolios are prevalent in the capital market. Their relative merits of return and risk criteria have to be

evaluated.

Mutual Fund

Mutual fund is an investment vehicle that pools together funds from investors to purchase stocks, bonds or other securities. An investor can participate in the mutual fund by buying the units of the fund. Each unit is backed by a diversified pool of assets, where the funds have been invested. A closed-end fund has a fixed number of units outstanding. It is open for a specific period. During that period investors can buy it. The initial offer period is terminated at the end of the pre-determined period. The closed-end schemes are listed in the stock exchanges. The investor can trade the units in the stock markets just like other securities. The prices may be either quoted at a premium or discount. In the open-end schemes, units are sold and bought continuously. The investors can directly approach the fund managers to buy or sell the units. The price of the unit is based on the net asset value of the particular scheme. The net asset value of the fund is the value of the underlying securities of the scheme. The net asset value is calculated on a daily or weekly basis. The gain or loss made by the mutual fund is passed on to the investors after deducting the administrative expenses and investment management fees, The gains are distributed to the unit holder in the form of dividend or reinvested by the fund to generate further gains. The mutual fund may be with or without a load factor. A commission or charge paid by the investors while purchasing or selling the mutual fund is known as load factor. Front- end load is charged when units are sold by the funds and back-end load is charged when the units are repurchased by the funds. The front-end load factor reduces the units when the investor buys it and the back-end load reduces the investor's proceeds when he sells the units. Generally, the load factor ranges between 1 and 6 per cent of the net asset value. Sometimes, the fund may not charge both the loads.

Advantages of Mutual Funds

The Association of Mutual Funds in India (AMFI), a non- profit organization serving the cause of mutual funds, has listed the following advantages to the investors in mutual funds.

Professional Management

Experienced fund managers supported by a research team, select appropriate securities to the fund. The forecasting of the market is done effectively.

1. Diversification

Mutual funds invest in a diverse range of securities and over many industries. Hence, all the eggs are not placed in one basket. Normally an investor has to have large sum of money to achieve this objective, if he invests directly in the stock market. Through mutual funds, he can achieve diversification of portfolio at a fraction of the cost.

2. Convenient Administration

For the investors there is reduction in paper work and saving in time. It is also very convenient. Mutual funds help in overcoming the problems relating to bad deliveries, delayed payments and the like.

3. Return Potential

Medium and the long-term mutual funds have the potential to provide high returns.

4. Low Costs

The funds handle the investments of a large number of people, they are in a position to pass on relatively low brokerage and other costs. This is because the funds can take advantage of the economies of scale.

5. Liquidity

Mutual funds provide liquidity in t ways. In open-end schemes, the investor can get back his money at any time by selling back the units to the fund at NAV related prices. In closed- end fund, he has the option to sell the units through the stock exchange.

6. Transparency

Mutual funds provide information on each scheme about the specific investments made there under and so on.

7. Flexibility

Currently most funds have regular investment plans, regular withdrawal plans and dividend reinvestment schemes. A great deal of flexibility is assured in the process.

8. Choice of Scheme

Mutual funds offer a variety of schemes to suit varying needs of the investors.

9. Well — Regulated

The funds are registered with the Securities and Exchange Board of India and their operations are continuously monitored.

10. Sharpe's Performance Index

Sharpe's performance index gives a single value to be used for the performance ranking of various funds or portfolios. Sharpe index measures the risk premium of the portfolio relative to the total amount of risk in the portfolio. This risk premium is the difference between the portfolio's average rate of return and the riskless rate of return. The standard deviation of the portfolio indicates the risk. The index assigns the highest values to assets that have best risk-adjusted average rate of return

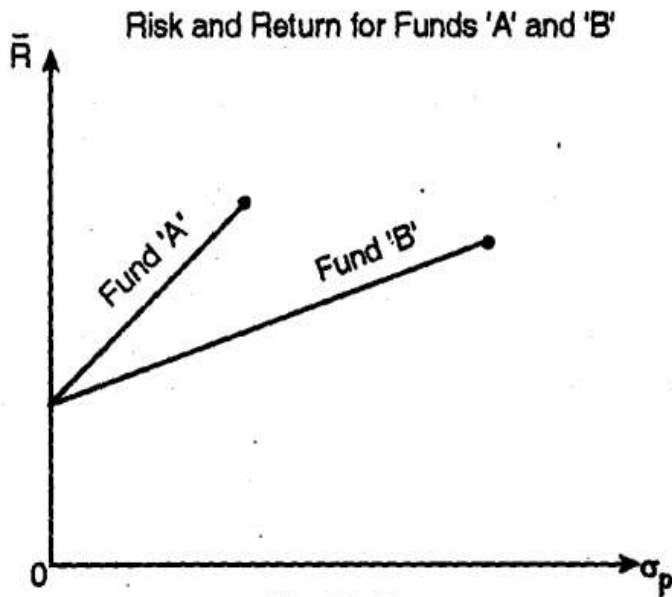
$$S_t = \frac{R_p - R_f}{\sigma_p}$$

$$\text{Sharpe Index} = \frac{\text{Portfolio average return} - \text{Risk free rate of interest}}{\text{Standard deviation of the portfolio return}}$$

The details of two hypothetical funds A and B are given below

Risk and Return for Funds A and B

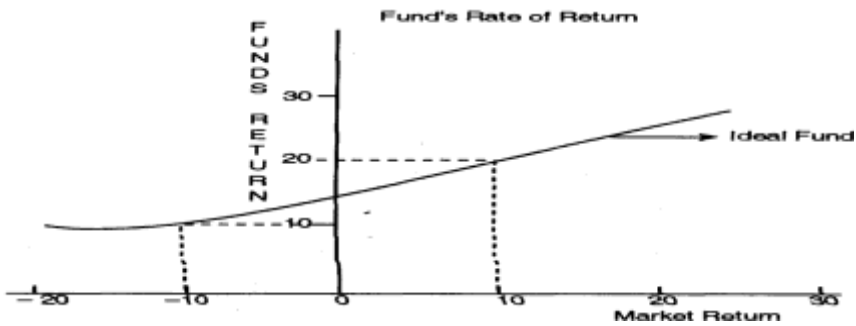
Fund	Average Annual Return	Riskless Rate of Interest	Standard Deviation	S_t
A	0.0879	0.05	0.0829	$\frac{0.0879 - 0.05}{0.0829}$ = 0.457
B	0.1347	0.05	0.1982	$\frac{0.1347 - 0.05}{0.1982}$ = 0.427



The larger the S , better the fund has performed. Thus, A ranked as better fund because its index $.457 > .427$ even though the portfolio B had a higher return of 13.47 per cent. It is shown in Figure. The reason is that the fund 'B's managers took such a great risk to earn the higher returns and its risk adjusted return was not the most desirable. Sharpe index can be used to rank the desirability of funds or portfolios, but not the individual assets. The individual asset contains its diversifiable risk.

Treynor's Performance Index

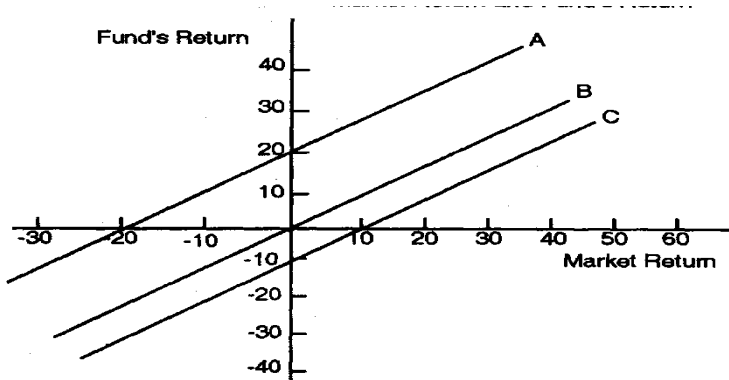
To understand the Treynor index, an investor should know the concept of characteristic line. The relationship between a given market return and the fund's return is given by the characteristic line. The fund's performance is measured in relation to the market performance. The ideal fund's return rises at a faster rate than the general market performance when the market is moving upwards and its rate of return declines slowly than the market return, in the decline. The ideal fund may place its fund in the treasury bills or short sell the stock during the decline and earn positive return. The relationship between the ideal fund's rate of return and the market's rate of return is given by the figure



The market return is given on the horizontal axis and the fund's rate of return on the vertical axis. When the market rate of return increases, the fund's rate of return increases more than proportional and vice-versa. In the figure the fund's rate of return is 20 per cent when the market's rate of return is 10 per cent, and when the market return is —10, the fund's return is 10 per cent. The relationship between the market return and fund's return is assumed to be linear. This linear relationship is shown by the characteristic line. Each fund establishes a performance relationship with the market. The characteristic line can be drawn by plotting the fund's rate of return for a given period against the market's return for the same period. The slope of the line reflects the volatility of the fund's return. A steep slope would indicate that the fund is very sensitive to the market performance. If the fund is not so sensitive then the slope would be a slope of less inclination. All the funds have the same slope indicating same level of risk. The investor would prefer A fund, because it offers superior return than funds C and B for the same level of risk exposure. This is shown in (Figure)

With the help of the characteristic line Treynor measures the performance of the fund. The slope of the line is estimated by

- $R_p = a + \beta R_m + e_p$
- R_p = Portfolio return
- R_m = The market return or index return
- e_p = The error term of the residual
- a, β = Co-efficient to be estimate



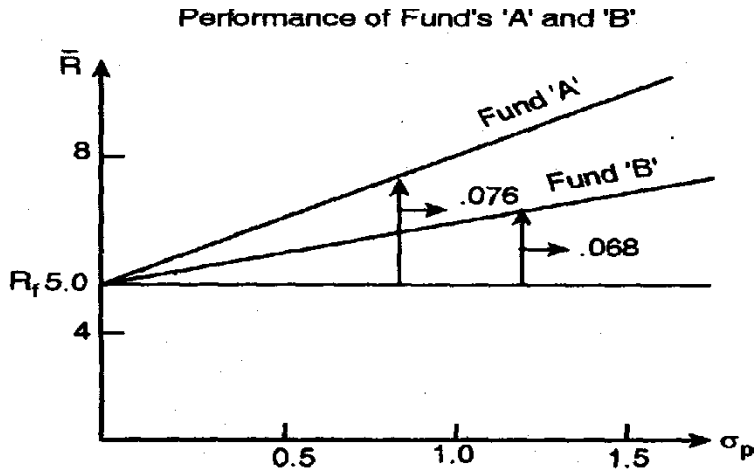
Beta co-efficient is treated as a measure of undiversifiable systematic risk

$$T_n = \frac{\text{Portfolio average return} - \text{Risk free rate of interest}}{\text{Standard deviation of the portfolio return}}$$

$$T_n = \frac{R_p - R_f}{\beta_p}$$

Treynor's risk premium of the portfolio is the difference between the average return and the riskless rate of return. The risk premium depends on the systematic risk assumed in a portfolio. Let us analyse to hypothetical funds.

Fund	Average Return	Beta	Risk Premium	R _f	T _n
A	0.0879	0.499	.0379	.05	$\frac{0.0879 - 0.05}{0.499}$ = 0.076
B	0.1347	1.2493	0.0847	.05	$\frac{0.1347 - 0.05}{1.2493}$ = 0.0678



Jensen's Performance Index

The absolute risk adjusted return measure was developed by Michael Jensen and commonly known as Jensen's measure. It is mentioned as a measure of absolute performance because a definite standard is set and against that the performance is measured. The standard is based on the manager's predictive ability. Successful prediction of security price would enable the manager to earn higher returns than the ordinary investor expects to earn in a given level of risk.

The basic model of Jensen is given below

$$R_p = \alpha + \beta (R_m - R_f)$$

R_p = average return of portfolio

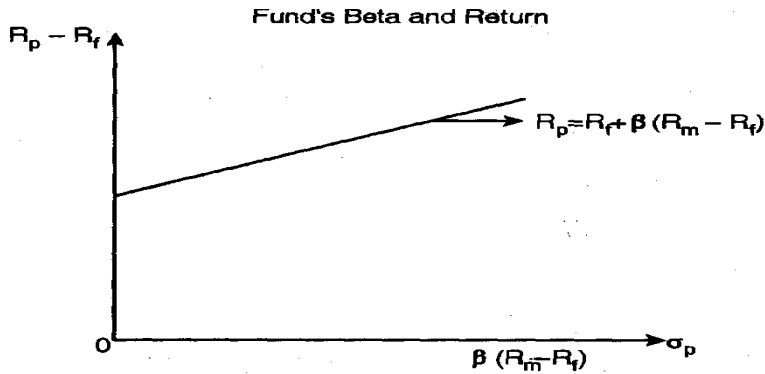
R_f = riskless rate of interest

α = the intercept

β = a measure of systematic risk

R_m = average market return

The return of the portfolio varies in the same proportion of β to the difference between the market return and riskless rate of interest. Beta is assumed to reflect the systematic risk. The fund's portfolio beta would be equal to one if it takes a portfolio of all market securities. The β would be greater than one if the fund's portfolio consists of securities that are riskier than a portfolio of all market securities. The figure shows the relationship between beta and fund's return.



Any professional manager would be expected to earn average portfolio return of $R = R_f + \beta (R_m - R_f)$. If his predictive ability is superior, he should earn more than other funds at each level of risk. If the fund manager has consistently performed better than average R_p , there would be some constant factor that would make the actual return higher than average R . The constant may be that represents the forecasting ability of the manager. Then the equation becomes

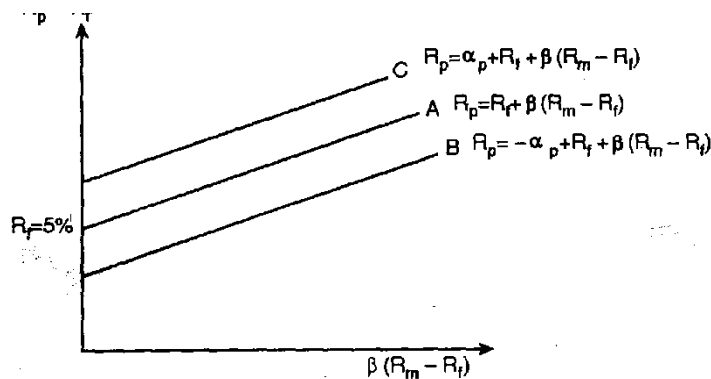
$$R_p - R_f = \alpha_p + \beta (R_m - R_f)$$

Or

$$R_p = \alpha_p + R_f + \beta (R_m - R_f)$$

By estimating this equation with regression technique, Jensen claimed the constant, reflected the professional management's ability to forecast the price movements. A comparative analysis of three hypothetical funds A, B and C are given in the figure.

Jensen's Measure of Management Ability



Fund A's α is equal to the risk free rate of return. If no risk is undertaken, the portfolio is expected to earn at least R_f . It is hypothesized that it takes no particular professional managerial ability to increase the return R_p by increasing $(R_m - R_f)$. In the fund C, the manager's predictive ability has made him earn more than R_f . The fund manager 'would be consistently performing better than the fund A. At the same time if the professional management has not improved, it 'would result in a negative α . This is shown by the line B. Here the is even below the riskless rate of interest. Jensen in his study of 115 funds, he found out that only 39 funds possessed positive α and employing professional management has improved the expected return. On an average, fund's performance is worse than expected, without professional management and if any investor is to purchase fund's shares, he must be very selective in his evaluation of management. Thus, Jensen's evaluation of portfolio performance involves two steps.

1. Using the equation the expected return should be calculated.
2. With the help of 3, R_m and R_f , he has to compare the actual return with the expected return. If the actual return is greater than the expected return, then the portfolio is considered to be functioning in a better manner. The following table gives the portfolio return and the market return. Rank the performance.

Portfolio Return and Market Return

Portfolio	R_p	β	R_f
A	15	1.2	5%
B	12	0.8	5%
C	15	1.5	5%
Market Index	12	1.0	5%

The return can be calculated with the given information using the formula: $R_p = R_f$

$$+ \beta (R_m - R_f)$$

$$\text{Portfolio A} = 5 + 1.2 (12 - 5) = 13.4$$

$$\text{Portfolio B} = 5 + 0.8 (12 - 5) = 10.6$$

$$\text{Portfolio C} = 5 + 1.5 (12 - 5) = 15.5$$

The difference between the actual and expected return is compared.

$$\text{Portfolio A} = 15 - 13.4 = 1.6$$

$$\text{Portfolio B} = 12 - 10.6 = 1.4$$

$$\text{Portfolio C} = 15 - 15.5 = -0.5$$

Among the risk adjusted performance and of the three portfolios, A is the best, B - the second best and the last is the C portfolio.

Example

Mr. X has owned units from three different mutual funds namely R, S, and T. The following particulars are available to him. He wants to dispose any one of the mutual fund for his personal expenditure. Which fund should he dispose?

Funds	Excess Average Return	Beta
R	7.7	1.02
S	11.3	0.99
T	11.6	1.07
Market	7.8	1.00

Ans: The performance can be evaluated by finding out the differential return. $R - R_f = \alpha + \beta (R_m - R_f)$

(or)

$$R_p - R_f = \alpha_p + \beta (R_m - R_f) \quad \text{Or}$$

$$R_p = \alpha_p + R_f + \beta (R_m - R_f)$$

Portfolio R

$$\alpha_p = (R_p - R_f) - \beta_p (R_m - R_f)$$

$$= 7.7 - 1.02 \times 7.8 = -2.56$$

Portfolio S

$$\alpha_p = 11.3 - .99 \times 7.8$$

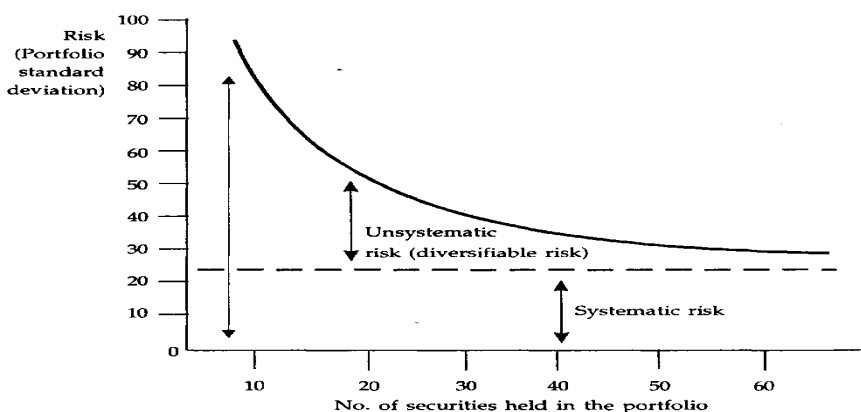
$$= 3.578$$

Portfolio C

$$\alpha_p = 11.6 - 1.07(7.8)$$

$$= 3.254$$

Since the Portfolio R has a negative alpha value Mr. X can sell the portfolio R and keep the other. For ranking purpose, Jensen measure should be properly adjusted. Each asset's alpha value should be divided by its beta co-efficient.



Portfolio Revision

The care taken in the construction of the portfolio should be extended to the review and revision of the portfolio. Fluctuations that occur in the equity prices cause substantial gain or loss to the investors. The investor should have

competence and skill in the revision of the portfolio. Normally the average investor dislikes to sell in the bull market with the anticipation of further rise. Likewise, he is reluctant to buy in the bear market with the anticipation of further fall. The portfolio management process needs frequent changes in the composition of stocks and bonds. In securities, the type of securities to be held should be revised according to the portfolio policy. If the policy of investor shifts from earnings to capital appreciation, the stocks should be revised accordingly. An investor can sell his shares if the price of shares reaches the historic high prices. Likewise, if the security does not fulfill the investor's expectation regarding return and growth, it is better to get rid of it. The investor should also consider the factors like risk, quality and tax concessions. If another stock offers a competitive edge over the present stock, investment should be shifted to the other stock. Many investors find themselves inadequate in their ability to trade and earn profit. Mechanical methods are adopted to earn better profit through proper timing. Such types of mechanical methods are Formula Plans and Swaps.

Passive Management

Passive management is a process of holding a well-diversified portfolio for a long term with the buy and hold approach. Passive management refers to the investor's attempt to construct a portfolio that resembles the overall market returns. The simplest form of passive management is holding the Index fund that is designed to replicate a good and well-defined index of the common stock such as BSE-Sensex or NSE-Nifty. The fund manager buys every stock in the index in exact proportion of the stock in that index. If Reliance Industry's stock constitutes 5% of the index, the fund also invests 5% of its money in Reliance Industry stock. The problem in the index fund is the transaction cost. If it is NSE-Nifty, the manager has to buy all the 50 stocks in market proportion and cannot leave the stocks with smallest weights to save the transaction costs. Further, the reinvestment of the dividends also poses a problem. Here, the alternative is to keep the cash in hand or to invest the money in stocks incurring transaction cost. Keeping away the stock of smallest weights and the money in hand fail to replicate the index fund in the proper manner. The commonly used approaches in constructing an index fund are as follows:

1. Keeping each stock in proportion to its representation in the index

2. Holding a specified number of stocks for example 20, which historically track the index in the best manner.
3. Holding a smaller set of stocks to match the index in a pre-specified set of characteristics. This may be in terms of sector, industry and the market capitalisation.

Active Management

Active Management is holding securities based on the forecast about the future. The portfolio managers who pursue active strategy with respect to market components are called 'market timers'. The portfolio managers vary their cash position or beta of the equity portion of the portfolio based on the market forecast. The managers may indulge in 'group rotation's. Here, the group rotation means changing the investment in different industries' stocks depending on the assessed expectations regarding their future performance.

Stocks that seem to be best bets or attractive are given more weights in the portfolio than their weights in the index. For example, Information Technology or Fast-Moving Consumer Goods industry stocks may be given more weights than their respective weights in the NSE-50. At the same time, stocks that are considered to be less attractive are given lower weights compared to their weights in the index. Here, the portfolio manager may either remain passive with respect to market and group components but active in the stock selection process or he may be active in the market, group and stock selection process.

The Formula Plans

The formula plans provide the basic rules and regulations for the purchase and sale of securities. The amount to be spent on the different types of securities is fixed. The amount may be fixed either in constant or variable ratio. This depends on the investor's attitude towards risk and return. The commonly used formula plans are rupee cost averaging, constant rupee value, the constant ratio and the variable ratio plans. The formula plans help to divide the investible fund between the aggressive and conservative portfolios. The aggressive portfolio consists more of common stocks which yield high return with high risk. The aggressive portfolio's return is volatile because the share prices

generally fluctuate. The conservative portfolio consists of more bonds that have fixed rate of returns. It is called conservative portfolio because the return is certain and the risk is less. The conservative portfolio serves as a cushion for the volatility of the aggressive portfolio. The capital appreciation in the conservative portfolio is rather slow and the fall in price of the bond or debenture is also alike.

Assumptions of the Formula Plan

1. The first assumption is that certain percentage of the investor's fund is allocated to fixed income securities and common stocks. The proportion of money invested in each component depends on the prevailing market condition. If the stock market is in the boom condition lesser funds are allotted to stocks. Perhaps it may be a ratio of 80 per cent to bonds and 20 per cent to stocks in the portfolio. If the market is low, the proportion may reverse. In a balanced fund, 50 per cent of the fund is invested in stocks and 50 per cent in bonds.
2. The second assumption is that if the market moves higher, the proportion of stocks in the portfolio may either decline or remain constant. The portfolio is more aggressive in the low market and defensive when the market is on the rise.
3. The third assumption is that the stocks are bought and sold whenever there is a significant change in the price. The changes in the level of market could be measured with the help of indices like BSE-Sensitive Index and NSE-Nifty.
4. The fourth assumption requires that the investor should strictly follow the formula plan once he chooses it. He should not abandon the plan but continue to act on the plan.
5. The investors should select good stocks that move along with the market. They should reflect the risk and return features of the market. The stock price movement should be closely correlated with the market movement and the beta value should be around 1.0. The stocks of the fundamentally strong companies have to be included in the portfolio.

Advantages of the Formula Plan

- Basic rules and regulations for the purchase and sale of securities are provided.
- The rules and regulations are rigid and help to overcome human emotion.
- The investor can earn higher profits by adopting the plans.
- A course of action is formulated according to the investor's objectives.
- It controls the buying and selling of securities by the investor.
- It is useful for taking decisions on the timing of investments.

Disadvantages

- The formula plan does not help the selection of the security. The selection of the security has to be done either on the basis of the fundamental or technical analysis.
- It is strict and not flexible with the inherent problem of adjustment.
- The formula plan should be applied for long periods, otherwise the transaction cost may be high.
- Even if the investor adopts the formula plan, he needs forecasting. Market forecasting helps him to identify the best stocks.

Rupee Cost Averaging

The simplest and most effective formula plan is rupee cost averaging. First, stocks with good fundamentals and long-term growth prospects should be selected. Such stocks' prices tend to be volatile in the market and provide maximum benefit from rupee cost averaging. Secondly, the investor should make a regular commitment of buying shares at regular intervals. Once he makes a commitment, he should purchase the shares regardless of the stock's price, the company's short-term performance and the economic factors affecting the stock market. In the rupee cost averaging plan, the investor buys varying number of shares at various points of the stock market cycle. In a way, it can be called time diversification. Let us assume that an investor decides to buy Rs11000 worth of particular shares for four quarters in one particular year, ignoring the transaction costs. The details are given in table

Rupee Cost Averaging (in `)

Quarter	Market Price	Shares Purchased	Cumulative Investment	Market value (in `)	Unrealised Profit or Loss	Average Cost per share	Average Market Price per share
1	100	10	1,000	1,000	0	100	100
2	90	11	1,990	1,890	(100)	94.76	95
3	100	10	2,990	3,100	110	96.45	96.67
4	110	9	3,980	4,400	420	99.50	100

In the above example, the stock price fell in the second quarter but recovered in the third quarter. The investor was able to buy more stocks in the second quarter than in the first quarter. The benefits of this policy can be viewed by comparing the last two columns. In the second quarter, the average cost per share is lower than the average market price per share. This is the benefit derived from rupee cost averaging. The rupee cost averaging for the Hero Honda stock is given in table. The process of investment is assumed to commence in January 1996 and end in 1998, covering 12 quarters.

Advantages

The advantages of the rupee cost averaging plan are

1. Reduces the average cost per share and improves the possibility of gain over a long period.
2. Takes away the pressure of timing the stock purchase from investors
3. Makes the investors to plan the investment programme thoroughly on the commitment of funds that has to be done periodically
4. Applicable to both falling and rising market, although it works best if the stocks are acquired in a declining market.

In a nut shell, the investor must decide in advance the sum and periodic intervals at which he has to invest. Once it is decided, the implementation is mechanical.

Limitations

1. Extra transaction costs are involved with small and frequent purchase of shares
2. The plan does not indicate when to sell. It is strictly a strategy for buying
3. It does not eliminate the necessity for selecting the individual stocks that are to be purchased
4. There is no indication of the appropriate interval between purchases
5. The averaging advantage does not yield profit if the stock price is in a downward trend
6. The plan seems to work better when stock prices have cyclical patterns.

The rupee cost averaging plan yields better results when applied to no load mutual funds. The problems of high transaction costs and stock selection are eliminated. The broad-based index fund experiences profit if the once is volatile, allowing the averaging effect to result in cost reduction. The investor has only to decide on the size of the fund and the length of the interval between the purchases.

Quarters	Price	Shares Bought	Total No. of Shares	Investment (₹)	Cumulative Investment (₹)	Market Value (₹)	Unrealised Profits (₹)	Average Cost (₹)	Average Price (₹)
1	2	3	4	5	6	7	8	9	10
15.1.96	112.00	90	90	10080	10080	10080		112	112
15.4.96	142.50	70	160	9975	20055	22800	2745	125	127
15.7.96	162.00	62	222	10044	30099	35964	5865	136	139
15.10.	130.00	77	299	10010	40109	3887	(1239)	134	137

96	0					0)		
15.1.97	152.00	66	365	10032	50141	55480	5339	137	140
7.4.97	156.50	64	429	10016	60157	67139	6982	140	143
15.7.97	301.75	33	462	9958	70115	139409	69294	152	165
15.10.97	381.88	26	488	9929	80044	186357	106313	164	192
15.1.98	390.75	26	514	10160	90204	200846	110642	176	214
15.4.98	606.25	16	530	9700	99904	321313	221409	189	254
15.7.98	443.50	23	553	10201	110105	245256	135151	199	271
15.10.98	571.00	17	570	9707	119812	325470	205658	210	296

Col 7 = Col 2 x Col 4

Col 8 = Col 7 x Col 6

Col 9 = Col 6 ÷ Col 4

Col 10 = I Qr Price + II Qr Price ÷ 2 and so on.

Constant Rupees Plan

Constant rupee, constant ratio and variable ratio plans are considered to be true formula timing plans. These plans force the investor to sell when the prices rise and purchase as prices fall. Forecasts are not required to guide buying and selling. The actions suggested by the formula timing plan automatically help the investor to reap the benefits of the fluctuations in the stock prices. The essential feature of this plan is that the portfolio is divided into two parts, which consists of aggressive and defensive or conservative portfolios. The portfolio mix facilitates the automatic selling and buying of bonds and stocks. The constant rupee plan enables the shift of investment from bonds to stocks and vice-versa by maintaining a constant amount invested in the stock portion of the portfolio. The

constant rupee plan starts with a fixed amount of money invested in selected stocks and bonds. When the price of the stocks increases, the investor sells sufficient amount of stocks to return to the original amount of the investment in stocks. By keeping the value of aggressive portfolio constant, remainder is invested in the conservative portfolio. The investor must choose action points or revaluation points. The action points are the times at which the investor has to readjust the values of the stocks in the portfolio. Stocks' values cannot be continuously the same and the investor has to be watchful of the market price movements. Stocks' value in the portfolio can be allowed to fluctuate to a certain extent. Percentage change in price like 5%, 10% or 20% can be fixed by the investor. Allowing only small percentage change would result in a lot of transaction cost and would not be beneficial to the investor. If the action points are too large, the investor may not be able get full benefit out of the price fluctuations. The table shows the constant rupee plan. The transaction costs are not considered.

Constant Rupee Plan

Period	Market Price (₹)	Number of Shares	Value of Stock Portfolio (₹)	Value of Defensive Portfolio (₹)	Total (₹)
1	50	200	10,000	10,000	20,000
2	44	200	8,800	10,000	18,800
3	40	200	8,000	10,000	18,000
4	40	250	10,000	8,000	18,000
Bought 50 Shares					
5	44	250	11,000	8,000	19,000
6	50	250	12,500	8,000	20,500
7	50	200	10,000	10,500	20,500
Sold 50 Shares					

According to the Table, the investor has ₹ 20,000 to invest and he divides it equally between stocks and bonds 50:50 that is 10,000:10,000. He makes quarterly adjustment if the stock portion falls or rises by 20%. In the third quarter, the stock

prices fell by 20% initiating the action. He shifted ₹ 2000 from the bonds' portion and bought 50 shares. This lifted the value of stock portion again to ₹ 10,000. In the fifth quarter, the stock price has increased from ₹ 40 to ₹ 50, a 20 per cent increase. In this action point the investor disposes off the shares and shifts the money to the bond portion. By this the stock amount in the portfolio has remained constant but the total portfolio value has increased. The investor stands to gain by the total portfolio value appreciation. The major advantage of this plan is that purchase and sales are determined automatically. This facilitates the investor to earn capital gain by selling the stocks when the price increases and buying it at a relatively lower price. To make the plan operate effectively, at the starting point, stocks should not be purchased either at high prices or at too low prices. If the investor starts the purchase at the extreme price level, the stock fund may be either too small or too large.

Constant Ratio Plan

Constant ratio plan attempts to maintain a constant ratio between the aggressive and conservative portfolios. The ratio is fixed by the investor. The investor's attitude towards risk and return plays a major role in fixing the ratio. The conservative investor may like to have more of bond and the aggressive investor, more of stocks. Once the ratio is fixed, it is maintained as the market moves up and down. As usual, action points may be fixed by the investor. It may vary from investor to investor. As in the previous example, when the stock price moves up or down by 10 to 20 per cent action would be taken. Here, 10 per cent is taken as action point. The table shows the constant ratio plan.

Constant Ratio Plan

Market Price	Number of Shares in Stock Portion	Value of Stock (₹)	Value of Defensive Portfolio (₹)	Total Portfolio Value (₹)	Ration of Stock Portion to Defensive Portion
50	100	5000	5000	10,000	1.00
48	100	4800	5000	9,800	0.96
45	100	4500	5000	9,500	0.90

` 248 transferred from bond portion and 5.5 shares purchased.					
45	105.5	4748	4752	9,500	1.00
40.5	105.5	4273	4752	9,025	0.90
Bought 5.9 shares by transferring ` 239 from bond portion					
40.5	111.4	4512	4511	9,023	1.00
44.5	111.4	4957	4511	9,468	1.10
5 shares are sold and invested in bonds to make the ratio equal 1:1					

The advantage of constant ratio plan is the automatism with which it forces the manager to counter adjust his portfolio cyclically. But this approach does not eliminate the necessity of selecting individual security. The limitation of the plan is that the money is shifted from the stock portion to bond portion. Bond is also a capital market instrument and responds to market pressures. Bond and share prices may both rise and fall at the same time. In the downtrend both prices may decline and then gain.

Variable Ratio Plan

According to this plan, at varying levels of market price, the proportions of the stocks and bonds change. Whenever the price of the stock increases, the stocks are sold and new ratio is adopted by increasing the proportion of defensive or conservative portfolio. To adopt this plan, the investor is required to estimate a long term trend in the price of the stocks. Forecasting is very essential to this plan. When there is a wide fluctuation variable ratio plan is useful. The table explains the variable ratio plan.

Variable Ratio Plan

Share price (₹)	Value of Stock portion (₹)	Value of Defensive (₹)	Total Portfolio value (₹)	Stock as a Percentage of Portfolio (₹)	Portfolio Adjustment	Shares in Stock Portion (₹)
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100	10,000	10,000	20,000	50.00	-	100
90	9,000	10,000	19,000	47.37	-	100
80	8,000	10,000	18,000	44.4	-	100
80	12,640	5,400	18,040	70.06	Bought 58 share s	158
90	14,220	5,400	19,620	72.48	-	158
100	15,800	5,400	21,200	74.53	Sold 50 sha res	158
100	10,800	10,800	21,600	50.00	-	108

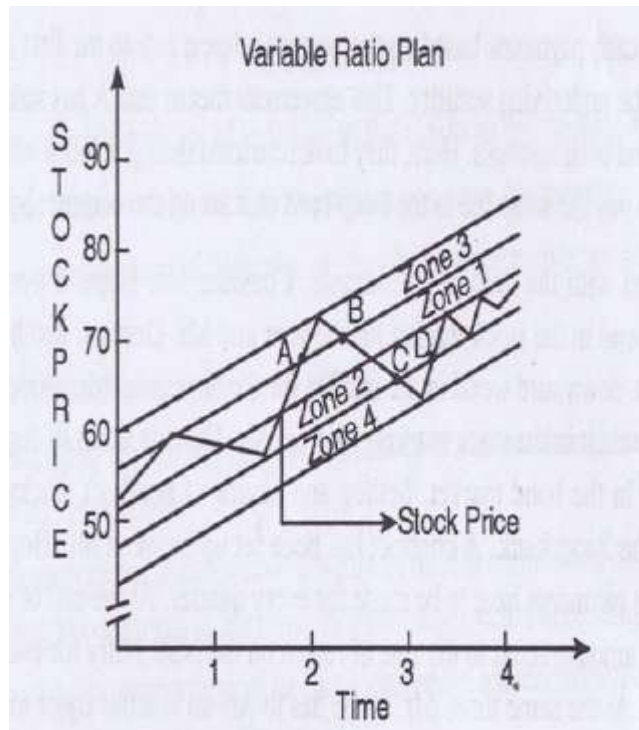
In the above example, the portfolio is adjusted for every 20 per cent change in the stock price. This adjustment criterion may be different for different investors depending upon their attitude towards risk and return. The portfolio is divided into two equal portions as in the case of other plans, with R,10,000 in each. Let us assume that there is a fall in the price of the stock, then, the percentage of stock in the portfolio declines. As the market price for the stock reaches a 20 per cent decline, that is to Rs,80, the adjustment action takes place. The purchase of 58 shares raises the stock portion to 72.48 per cent. Once again, when there is a 20 per cent change, the adjustment action is triggered. When the prices have increased to ` 100, the investor sells 50 shares and the stock portion in the portfolio is reduced back to 50 per cent.

The figure explains the variable ratio plan.

The middle line is the trend line that represents the investor's expectation about of future course of prices. Zone 1 and 3 represent respectively of 10 and 20 per cent deviations above the expected trend, and zones 2 and 4 represent respectively 10 and 20 per cent deviations below the expected trend. Starting at ` 50, the portfolio's bonds and stocks ratio is 50:50.

At point A, the portfolio is adjusted to the next proportion, in this case

60 per cent bonds and 40 per cent stocks. At B, again it is 50:50. Below point C there would be more stocks than bonds. Because of the decline in stock price, more stocks are purchased. Above the point D, it is again 50:50. The line moves closer to the trend line



Advantages

Automatically, the investor tends to correct his portfolio portions according to the price changes. The investor is not emotionally affected by the price changes in the market. With accurate forecast the variable ratio plan takes greater advantage of price fluctuations than the constant ratio plan.

Limitations

1. The investor has to construct the appropriate zones and trend for alterations of the proportions

2. The selection of security has to be done by the investor by analysing the merits of the stock. The plan does not help in the selection of scrips.
3. If the zones are too small frequent changes have to be done and it would limit portfolio performance.

Revision and the Cost

With the passage of time the stocks which were attractive once may turn out to be less attractive in terms of return. The investor's attitude towards risk and return also may change and the forecast regarding the market also may undergo change. In this context, the necessary revision is thought of by the portfolio manager. In revision of traded volumes the portfolio manager has to incur brokerage commission, price impact and bid-ask spread. Price impact means the effects on the price of stock. In simple terms, if the size of the trade is heavy on the buying side, the prices of the stock may increase. The bid-ask spread is the difference between the price that the market maker is willing to buy and sell the stock. These costs may be higher in small size stocks and the benefits of revision may be nullified by it. Usually, revision is done with the view of either increasing the expected return of the portfolio or to reduce the risk (standard deviation) of the portfolio.

SWAPS

Swap is a contract between two parties to exchange a set of cash flows over a pre-determined period of time. The two parties are known as counter parties. In an equity swap one counter party, say 'A', agrees to pay cash based on the rate of return of an agreed stock market index to the second counter party 'B'. Since the payments are based on the market index, they vary according to index movements. The second counter party B agrees to pay the fixed amount of cash payments based on the current interest rate to the first counterparty A. Thus, the payment depends upon the underlying security. This agreement means that A has sold stocks and bought bonds while B has sold bonds and bought stocks. Here, they have restricted their portfolios without the transaction costs, even though they have to pay the swap fee to the swap bank that set up the contract between the two parties.

This can be explained with the help of an example. Consider Mr. Hope, a

portfolio manager having an expectation of upward trend in the stock market for the year and Mr. Despair, another portfolio manager who feels that there would be downward trend in the market for the next year. Mr. Hope wants to sell ₹ 10 lakhs worth of bonds and to invest it in the stock market, whereas Mr. Despair wants to dispose off ₹ 10 lakhs worth of stocks to be invested in the bond market. Selling and buying of bonds or stocks involve transaction cost. Hence, they approach the Swap bank. A contract has been set up between Mr. Hope and Mr. Despair by the swap bank. The contract payments have to be made for every quarter. At the end of each quarter, Mr. Despair has to pay Mr. Hope an amount equal to the rate of return on the NSE-Nifty for every quarter in terms of the basic principal amount. At the same time, Mr. Hope has to pay an amount equal to 3% of the principal. The agreed notional principal amount is ₹ 10 lakhs. The contract lasts for an year. They pay fees to the swap bank. Let us assume that the rates of return of NSE-Nifty are 5%, -2%, 3% and 6% for the four quarters. Mr. Hope has to pay ₹ 30,000 to Mr. Despair each quarter, the payments Mr. Despair has to make to the Mr. Hope are as follows:

Quarter	NSE-Nifty Return	Mr. Hope's Cashflows			Mr. Despair Cashflows.		
		Payment From Despair (₹)	Payment to Despair (₹)	Net outflows (₹)	Payment From Hope (₹)	Payment to Hope (₹)	Net outflows (₹)
First	5%	50,000	30,000	-20,000	30,000	50,000	20,000
Second	-2%	-20,000	30,000	50,000	30,000	-20,000	-50,000
Third	3%	30,000	30,000	00000	30,000	30,000	00,000
Fourth	6%	60,000	30,000	-30,000	30,000	60,000	30,000

The results can be summarised

First Quarter Mr. Despair pays ₹ 20,000 to Mr. Hope
 Second Quarter: Mr. Hope pays ₹

50,000 to Mr. Despair Third Quarter: There is no payment

Fourth Quarter: Ir. Despair pays ` 30,000 to Mr. Hope

The amount paid by Mr. Despair shows what would have transacted if Mr. Despair had sold stocks and bought bonds. Likewise the payments made by Mr. Hope indicates what would have happened if he had sold bonds and bought stocks. The equity swaps could be modified based upon the index and the prevailing interest rates.

Summary

- The CAPM model is based on specific assumptions. The investor could borrow or lend any amount of money at riskless rate of interest.
- All investors hold only the market portfolio and the riskless securities.
- Market portfolio consists of the investments in all securities of the market. The proportion invested in each security is equal to the percentage of the total market capitalisation represented by the security.
- The capital market line represents the relationship between the expected return and standard deviation of the portfolio.
- The risk of the security is indicated by its covariance with the market portfolio.
- Security market line shows the linear relationship between the expected returns and betas of the securities.
- The objective of the asset pricing model is to identify the equilibrium asset price for expected return and risk. If the asset prices are not equal, there is a scope for arbitrage.
- An arbitrage portfolio is constructed without any additional financial commitment.
- Investors indulge in arbitrage, moving the price upwards if securities

are held long and driving down the price of securities if held in short position, till the elimination of the arbitrage possibilities.

- The factor sensitivity in arbitrage model indicates the responsiveness of a security's return to a particular factor.
- Portfolio evaluation is carried out to assess the risk and return of the different portfolios.
- Mutual funds pool together the funds from investors by selling units and invest them in different types of securities.
- Closed-end funds are open for a specific period for subscription. The open-ended funds units are available continuously.
- Sharpe index is a measure of risk premium related to the total risk.
- Treynor index measures the fund's performance in relation to the market performance.
- Jensen index compares the actual or realised return of the portfolio with the calculated or predicted return. Better performance of the fund depends on the predictive ability of the managerial personnel of the fund.
- Passive management of funds consists of indexing of the stocks to be purchased. In active management funds are allocated to buy active stocks in the market.
- Aggressive portfolio consists more of common stocks while conservative portfolio consists more of bonds or debentures.
- Portfolios are revised with the help of formula plans.
- In the rupee cost averaging technique, varying amount of shares are bought at regular intervals. This is time diversification of the portfolio.
- According to the constant rupee plan constant amount of fund is maintained for the shares. The shifting of funds from aggressive to conservative portfolio or vice-versa occurs according to the price fluctuations.

- In the variable ratio plan, the proportions of funds on aggressive and conservative portfolios change according to the varying levels of security market prices.
- In an equity swap two parties agree to make payments to each other based on the stock market price and interest rate.

Solved Problems

1. Security J has a beta of 0.75 while security K has a beta of 1.45. Calculate the expected return for these securities, assuming that the risk-free rate is 5 per cent and the expected return of the market is 14 per cent.

Solution

The expected return can be calculated using CAPM $R_i =$

$$R_f + \beta_i (R_m - R_f)$$

For Security J

$$\begin{aligned} R_i &= 5 + 0.75 (14 - 5) \\ &= 5 + 6.75 = 11.75 \text{ per cent} \end{aligned}$$

For Security K

$$\begin{aligned} R_i &= 5 + 1.45 (14 - 5) \\ &= 5 + 13.05 = 18.05 \text{ per cent} \end{aligned}$$

Solution

- (a) We can use CAPM to determine which of the securities listed are underpriced. For this we have to calculate the expected return on each security using CAPM equation:

$$R_i = R_f + \beta_i (R_m - R_f)$$

Given that R_f (Govt. security return rate) = 7 and R_m 15 The equation becomes

$$R_i = 7 + \beta_i(15 - 7)$$

Now,

$$\text{Security A} = 7 + 2.0(15 - 7) = 7 + 16 = 23 \text{ per cent}$$

$$\text{Security B} = 7 + 1.5(15 - 7) = 7 + 12 = 19 \text{ per cent}$$

$$\text{Security C} = 7 + 1.0(15 - 7) = 7 + 8 = 15 \text{ per cent}$$

$$\text{Security D} = 7 + 0.8(15 - 7) = 7 + 6.4 = 13.4 \text{ per cent}$$

$$\text{Security E} = 7 + 0.5(15 - 7) = 7 + 4 = 11 \text{ per cent}$$

The expected return as per CAPM formula and the estimated return of each security can be tabulated.

Security	Expected return (per cent)	Estimated return (per cent)
A	23.0	30.0
B	19.0	25.0
C	15.0	20.0
D	13.4	11.5
E	11.0	10.0

A security whose estimated return is greater than the expected return is assumed to be underpriced because it offers a higher return than that expected from securities with the same risk.

Accordingly, securities A, B and C are underpriced.

To calculate the expected return and risk R_p and β_p we need to calculate β_{pr} first

As the proportion of investment in each security is equal, $w_i = 0.20$

$$\begin{aligned}\beta_p &= (0.2)(2.0) + (0.2)(1.5) + (0.2)(1.0) + (0.2)(0.8) + (0.2)(0.5) \\ &= (0.2)(2.0 + 1.5 + 1.0 + 0.8 + 0.5) \\ &= (0.2)(5.8) = 1.16 \text{ Expected return of portfolio} \\ R_p &= R_f + \beta_p(R_m - R_f) \\ &= 7 + 1.16(15 - 7) \\ &= 7 + 9.28 = 16.28 \text{ per cent}\end{aligned}$$

Systematic risk of the portfolio $\beta_p = 1.16$

2. An investor owns a portfolio that over the last five years has produced 16.8 per cent annual return. During that time the portfolio produced a 1.10 beta. Further, the risk free return and the market return averaged 7.4 per cent and 15.2 per cent per year respectively. How would you evaluate the performance of the portfolio?

Solution

The Treynor ratio can be used to evaluate the performance of the portfolio in this case.

$$= \frac{r_p - r_f}{\beta_p}$$

Treynor ratio (TR) for the portfolio =

$$= \frac{16.8 + 7.4}{1.10} = \frac{24.2}{1.1} = 22$$

$$\text{Treynor ratio (TR) for market index} = \frac{15.2 + 7.4}{1.10} = \frac{22.6}{1.1} = 20.55$$

The ratio for the market index can be taken as the benchmark for evaluation.

The portfolio has a reward to volatility ratio higher than that of the market index. Hence, the performance of the portfolio can be considered superior.

3. You are given the following historical performance information on the capital market and a mutual fund:

Year	Mutual fund beta	Mutual fund return (per cent)	Return on market index (per cent)	Return on Govt. securities (per cent)
1	0.90	-3.00	-8.50	6.50
2	0.95	1.50	4.00	6.50
3	0.95	18.00	14.00	6.00
4	1.00	22.00	18.50	6.00
5	1.00	10.00	5.70	5.75
6	0.90	7.00	1.20	5.75
7	0.80	18.00	16.00	6.00
8	0.75	24.00	18.00	5.50
9	0.75	15.00	10.00	5.50
10	0.70	-2.00	8.00	6.00

Calculate the following risk adjusted return measures for the mutual fund:

- Reward-to-variability ratio
- Reward-to-volatility ratio

Comment on the mutual fund's performance.

Solution

As the first step in calculation, the average values of the four variables may be calculated. The averages are as follows:

Mutual fund beta = 0.87

Mutual fund return = 11.05 per cent

Return on market index = 8.69 per cent

Return on govt. securities = 5.95 per cent

(a) Reward to variability ratio or Sharpe ratio

$$SR = \frac{r_f - r_f}{\sigma_f}$$

For the calculation of this ratio, σ_f or mutual fund's standard deviation of returns, is required.

.Calculation of Standard deviation

Year	Mutual fund returns	X ²
1	-3.00	9.00
2	1.50	2.25
3	18.00	324.00
4	22.00	484.00
5	10.00	100.00
6	7.00	49.00
7	18.00	324.00
8	24.00	576.00
9	15.00	225.00
10	-2.00	4.00
Total	110.50	2097.25

$$\begin{aligned}
 \sigma_p &= \sqrt{\frac{N\sum X^2 - (\sum X)^2}{N^2}} \\
 &= \sqrt{\frac{(10 \times 2097.25) - (110.5)^2}{10 \times 10}} \\
 &= \sqrt{\frac{20972.50 - 12210.25}{100}} \\
 &= \sqrt{87.62} = 9.36 \text{ per cent} \\
 \text{SR} &= \frac{11.05 - 9.36}{9.36} = 0.545
 \end{aligned}$$

(B) Reward to volatility ratio or Treynor ratio

$$\begin{aligned}
 \text{TR} &= \frac{r_p - r_f}{\beta_p} \\
 &= \frac{11.05 - 9.36}{0.87} = 5.86
 \end{aligned}$$

Mutual Fund performance

For evaluating the mutual fund performance we have to calculate the Sharpe and Treynor ratios for the market index to be used as the benchmark. For calculating the Sharpe ratio for the market index, the standard deviation of returns on the market index has to be calculated.

Calculation of Standard deviation

Year	Mutual fund returns	X ²
1	-8.50	72.25
2	4.00	16.00
3	14.00	196.00
4	18.50	342.25
5	5.70	32.49
6	1.20	1.44
7	16.00	256.00
8	18.00	324.00
9	10.00	100.00
10	8.00	67.00
Total	86.90	1404.43

$$\begin{aligned}
 \sigma_m &= \sqrt{\frac{N\sum X^2 - (\sum X)^2}{N^2}} \\
 &= \sqrt{\frac{(10 \times 1404.43) - (86.90)^2}{10 \times 10}} \\
 &= \sqrt{\frac{14044.30 - 7551.61}{100}} \\
 &= \sqrt{64.93} = 8.06 \text{ per cent}
 \end{aligned}$$

Sharpe and Treynor ratios for the market index:

$$\begin{aligned} \text{Sharpe ratio} &= \frac{r_p - r_f}{\sigma_p} \\ &= \frac{8.69 + 5.95}{8.06} = \frac{2.74}{8.06} = 0.34 \end{aligned}$$

$$\text{Treynor ratio} = \frac{r_m - r_f}{\beta_m}$$

8.06

$$\begin{aligned} \sigma_m &= \sqrt{\frac{N\sum X^2 - (\sum X)^2}{N^2}} \\ &= \sqrt{\frac{(10 \times 1404.43) - (86.90)^2}{10 \times 10}} \\ &= \sqrt{\frac{14044.30 - 7551.61}{100}} \\ &= \sqrt{64.93} = 8.06 \text{ per cent} \end{aligned}$$

Sharpe and Treynor ratios for the market index:

$$\begin{aligned} \text{Sharpe ratio} &= \frac{r_p - r_f}{\sigma_p} \\ &= \frac{8.69 + 5.95}{8.06} = \frac{2.74}{8.06} = 0.34 \end{aligned}$$

$$\text{Treynor ratio} = \frac{r_m - r_f}{\beta_m}$$

$$= \frac{8.69 + 5.95}{1.00} = \frac{2.74}{1.00} = 2.74$$

Ratios of the mutual fund and the market index may be tabulated as:

Ratio	Mutual fund	Market index
Sharpe ratio	0.545	0.34
Treynor ratio	5.86	2.74

Mutual fund has performed better than the market.

4. Information regarding two mutual funds and a market index are given below:

Fund	Return per cent	Standard deviation (per cent)	Beta
Gold	7	15	0.72
Platinum	16	35	1.33
Market index	10	24	1.0

Assuming the risk – free return as 5 per cent, calculate the differential return for the two funds.

Solution

Differential return, as per Jensen ratio, is calculated as:

$$\alpha_p = R_p - E(R_p)$$

The expected return of the portfolio, $E(R_p)$, can be calculated using the CAPM formula.

$$E(R_p) = R_f + \beta_p(R_m - R_f)$$

$$\text{Gold fund: } E(R_p) = 5 + 0.72(10 - 5)$$

$$= 5 + 3.6 = 8.6 \text{ per cent}$$

$$\text{Platinum fund: } E(R_p) = 5 + 1.33(10 - 5)$$

$$= 5 + 6.65 = 11.65 \text{ per cent}$$

Differential return

$$\text{Gold fund: } \alpha_p = 7 - 8.6 = -1.6 \text{ per cent}$$

$$\text{Platinum fund: } \alpha_p = 16 - 11.65 = 4.35 \text{ per cent}$$

5. From the information given in example 3, calculate net selectivity measure for the platinum fund using Fama's framework of performance components.

Solution

We have the following information:

$$\begin{aligned} R_p &= 16 \text{ per cent} \\ \sigma_p &= 35 \text{ per cent} \\ R_M &= 10 \text{ per cent} \\ \sigma_M &= 24 \text{ per cent} \\ R_f &= 5 \text{ per cent} \\ \beta_p &= 1.33 \end{aligned}$$

Fama's decomposition may be stated as:

$$R_p = R_f + R_1 + R_2 + R_3$$

$$R_f = 5 \text{ per cent}$$

$$\begin{aligned} R_1 &= \beta_p(R_M - R_f) \\ &= 1.33(10 - 5) = 6.65 \text{ per cent} \end{aligned}$$

$$\begin{aligned} R_2 &= [(\sigma_p/\sigma_M) - \beta_p](R_M - R_f) \\ &= [(35/24) - 1.33](10-5) \\ &= (1.46 - 1.33)(5) \\ &= 0.65 \text{ per cent} \end{aligned}$$

$$R_3 = 16 - (5 + 6.65 + 0.65) = 16 - 12.3 = 3.70 \text{ per cent}$$

Thus

$$R_p = 5 + 6.65 + 0.65 + 3.70 = 16 \text{ per cent}$$

Alternatively, Fama's net selectivity can be directly calculate as follows: Fama's net selectivity

$$\begin{aligned} R_p &= [R_f + (\sigma_p/\sigma_M)(R_M - R_f)] \\ &= 16 - [5 + (35/24)(10 - 5)] \\ &= 16 - (5 + 7.3) \\ &= 16 - 12.30 = 3.70 \text{ per cent.} \end{aligned}$$

Input Data

Security	Weightage (ω_i)	Alpha (α_i)	Beta (β_i)	Residual variance (σ^2) e_i
A	0.2	2.0	1.7	370
B	0.1	3.5	0.5	240
C	0.4	1.5	0.7	410
D	0.3	0.75	1.3	285
Portfolio value	1.0	1.575	1.06	108.45

The values of the portfolio alpha, portfolio beta, and portfolio residual variance can be calculated as the first step.

$$\begin{aligned} \alpha_p &= \sum \omega_i \alpha_i \\ &= (0.2)(2) + (0.1)(3.5) + (0.4)(1.5) + (0.3)(0.75) \\ &= 1.575 \\ \beta_p &= \sum \omega_i \beta_i \\ &= (0.2)(1.7) + (0.1)(0.5) + (0.4)(0.7) + (0.3)(1.3) \\ &= 1.06 \\ \text{Portfolio residual variance} &= \sum \omega_i^2 \sigma_i^2 \\ &= (0.2)^2(370) + (0.1)^2(240) + (0.4)^2(410) + (0.3)^2(285) \\ &= 108.45 \end{aligned}$$

These values are noted in the last row of the table. Using these values, we can calculate the expected portfolio return for any value of projected market return. For a market return of 15 per cent, the expected portfolio return would be:

$$R_p = \alpha_p + \beta_p R_m = 1.575 + (1.06)(15) = 17.475$$

For calculating the portfolio variance, we need the variance of the market returns. Assuming a market return variance of 320, the portfolio variance can be calculated as:

$$\sigma_p^2 = \beta_p^2 \sigma_m^2 + \sum \omega_i^2 \sigma_i^2 = (1.06)^2(320) + 108.45 = 468.002$$

Self-Assessment Questions

1. What are the basic assumptions of CAPM? What are the advantage of adopting CAPM model in the portfolio management?

2. What is meant by levered portfolio? How it is constructed?
3. Explain the CAPM theory and its validity in the stock market?
4. Describe the basic arbitrage pricing theory model of two factors?
5. What are the advantages of APT over CAPM? Explain in detail.?
6. What is meant by mutual funds? What are the advantage of professionally of managed portfolio?
7. Dintinguish between the open –end and closed-end mutual funds.
8. Givan an account of the various types of mutual funds available in the capital market?
9. State the reason for the treynor and sharpe giving conflicting performance ranking?
10. Disting between the security market line and capital market line?

CASE STUDY

You are young derivates trader. This is your first month on a corporate desk. A long-time client with substantial exports to Australia calls up. The client is expecting an inflow of AUD 200 million in six months' time. During the discussion, it transpires that there are no direct options contracts for the dates the client is looking for. The client has burnt his fingers in earlier options contracts, when the market moved against and an American Put go exercised. You suggest that the client can hedge this by a forward sale, purchase of a put option or by a strategy known as covered call writing. After the day's trading is over you meet the chief trader and discuss this deal. The chief trader is not amused. Why? Compare the possibilities and explain using options algebra. You succeed in convincing our client to take a suitable option on AUD 100 million and a 6-month forward on remaining AUD 100 million through USD. You are able to make a neat sum through this deal for your company. Once again, your chief trader is not happy with you. He is asking what if the portfolio of the client sees large movements. You say you have tested if for delta neutrality. Convince the

chief trader. It seems that the chief trader is out to test your knowledge. Now, you are asked to report the impact of cross currency movement on all the Greeks of this client's portfolio.

Questions

- (a) What information do you need? What analysis will you carry out?
- (b) How will you communicate with client and chief trader?

MODEL QUESTION AND ANSWERS

1. What is investment? Give some real-world examples.

Investment means allocating money or resources to an asset or project expecting future income or capital gain. It involves sacrificing current funds for potential future benefits. Common examples include purchasing stocks, bonds, or real estate. Mutual funds and fixed deposits are also popular. Starting or expanding a business is another form of investment. Real-world examples are buying shares of companies like Apple, investing in government bonds for stable returns, or purchasing rental property to generate regular income and capital appreciation over time. Investments aim to grow wealth while balancing risk and return.

2. How do investments differ from speculation?

Investment involves committing money over the long term based on thorough analysis, aiming for steady returns and wealth creation. It focuses on underlying asset value and sustainable growth. Speculation, in contrast, is short-term, focusing on capitalizing on price fluctuations, often with high risk and uncertain outcomes. Speculators rely on market trends, rumors, or technical signals rather than fundamentals. While investors prioritize risk management and income, speculators pursue quick profits, accepting greater risk. Thus, investment emphasizes safety and growth, whereas speculation involves guesswork and higher risk-taking.

3. Examine the similarities between investment and speculation.

Both investment and speculation involve allocating capital in financial markets to generate returns. They require market knowledge, understanding risks, and timing decisions. Each aims for profit by buying securities expecting future value increases. Both activities involve analyzing market conditions, though methods may differ. Both subject participants to potential losses, influenced by economic and market factors. They are conducted in similar markets—stocks, bonds, commodities. Hence, investment and speculation share the common ground of financial commitment, risk-taking, and reliance on market

dynamics to achieve financial gains, though their approaches and risk tolerance differ.

4. Discuss factors that differentiate investor from speculator and gambler.

Investors seek long-term wealth through careful analysis and risk management, emphasizing asset fundamentals and sustainable returns. Speculators take higher short-term risks, relying on market trends to profit from price changes. Gamblers depend mostly on chance or luck, with little to no analysis or strategy. Investors use disciplined approaches; speculators may employ technical analysis; gamblers often act emotionally. Investors diversify holdings; speculators concentrate bets, increasing risk. Time horizon varies—investors plan long-term, speculators short-term, gamblers immediate. Objectives differ: wealth creation versus quick gains or thrill. These distinctions clarify roles and risk attitudes in market participants.

5. What are income shares? What need of the investor does it satisfy?

Income shares are equity shares of companies that provide steady and regular dividends, focusing on delivering income rather than capital gains. These appeals to investors seeking stable cash flow, such as retirees or conservative investors requiring periodic income. Income shares prioritize dividend distribution, reflecting the company's earning stability and financial health. They satisfy the need for current income while potentially offering modest capital growth. Such shares often belong to well-established firms with predictable earnings and payout policies, helping investors balance income generation with moderate growth prospects.

6. Outline the characteristics of bonds.

Bonds are debt instruments issued by governments or corporations to raise capital. They have fixed maturity dates and promise periodic interest payments (coupons) to investors. Bonds are usually considered safer than stocks as they have priority over equity in case of liquidation. They provide predictable income streams and capital repayment at maturity. Bonds' prices fluctuate based on interest rate changes, credit risk, and

market conditions. They can be traded in secondary markets. Bonds vary by issuer, duration, credit quality, and tax status. They are essential for income-focused and risk-averse portfolios.

7. What do you mean by rate of return?

Rate of return is the percentage gain or loss on an investment over a period relative to the initial amount invested. It includes income components such as dividends or interest and capital appreciation or depreciation. It quantifies investment profitability. For example, if an investment of ₹100 gains ₹10 annually, the rate of return is 10%. It can be calculated for different intervals (monthly, annually) and helps compare various assets or portfolios. Investors use it to assess performance and make informed decisions balancing risk and reward.

8. What are the investor objectives in investing funds in stock market?

Investor objectives in stock market investments include capital growth through appreciation of stock prices, earning regular income via dividends, and portfolio diversification to manage risk. Other objectives include liquidity, enabling easy buying and selling of shares, and tax benefits from long-term capital gains or dividend income. Investors seek a balance between risk and returns aligned with their financial goals and time horizons. Some aim for aggressive growth, others for income stability. Understanding these objectives helps tailor investment strategies and select suitable securities.

9. Explain in detail primary and secondary objectives of investment.

Primary objectives include safety of principal, ensuring capital is not lost; liquidity, providing easy conversion to cash; and growth, aiming for capital appreciation. Secondary objectives involve tax efficiency, reducing tax liabilities; convenience, easy management of investments; diversification, spreading investment across asset classes; and marketability, ensuring ease of transfer or sale. These combined objectives help investors maintain capital, earn steady returns, and meet their financial needs. Effective investment strategies balance these goals based on individual preferences and risk tolerance.

10. How do you classify investors?

Investors are classified by risk tolerance into conservative (low risk), moderate (balanced risk), and aggressive (high risk) types. By investment horizon, they are short-term, seeking quick returns, or long-term, aiming for sustained growth. Classification also depends on objectives—those focused on income, growth, or capital preservation. Another classification is by knowledge and sophistication: retail investors, institutional investors, and accredited investors. Understanding investor categories helps in designing suitable investment products and strategies.

11. What are non-marketable securities?

Non-marketable securities are financial instruments that cannot be transferred or traded in open markets. They are usually issued directly to and can only be redeemed by the issuer, making them illiquid. Examples include savings certificates, post office deposits, National Savings Certificates (NSC), Employee Provident Fund (EPF), Public Provident Fund (PPF), and certain government and corporate bonds sold directly to investors. Such securities are valued for their safety and steady returns, often providing tax benefits. Investors choose them for long-term savings, capital preservation, and assured returns rather than for liquidity or speculative gains.

12. Summarize the method of choosing mutual fund for profitable investment.

To select a profitable mutual fund, first clarify your investment goals and risk tolerance. Analyze the fund's historical performance compared to its benchmark and peers. Assess the expertise and track record of the fund manager, and review the portfolio's holdings for diversification and sector allocation. Study the fund's expense ratio—lower costs mean more returns compound for you. Check liquidity, exit load, and tax implications. Lastly, read the scheme information document for details on objectives and strategy. Choosing funds across different categories further diversifies risk and enhances return potential in your portfolio.

13. Which is riskier? Corporate bonds or T-bills? Justify.

Corporate bonds are riskier than Treasury bills (T-bills). T-bills are short-term debt instruments issued by the government, carrying virtually zero default risk due to sovereign backing—making them the safest fixed-income investment. Corporate bonds are issued by companies and carry credit risk, as companies could default on interest or principal repayment.

While corporate bonds offer higher yields to compensate for greater risk, they are exposed to business and economic uncertainties. T-bills' low risk makes them highly suitable for capital preservation, whereas corporate bonds fit investors seeking higher returns with a higher risk tolerance.

14. Illustrate about the investment triangle.

The investment triangle visually represents the trade-off among three key investment objectives: safety, liquidity, and growth. Each corner of the triangle symbolizes one of these demands. Typically, an investment can excel at only two aspects but not all three simultaneously. For example, savings accounts offer safety and liquidity but low growth, stocks offer growth and liquidity but less safety, and fixed deposits provide safety and some growth but lack liquidity. The triangle helps investors visualize that optimizing all three parameters at the same time is rarely possible, guiding wise portfolio construction.

15. What is meant by ETF and Hedge fund?

An Exchange-Traded Fund (ETF) is an investment fund traded on stock exchanges, holding assets like stocks, bonds, or commodities. ETFs provide diversification, liquidity, and low costs, often tracking specific indices. Hedge funds are private, pooled investment vehicles using advanced strategies—leverage, short-selling, derivatives—for high returns. They target accredited investors, charging higher fees, and can take on greater risk in both rising and falling markets. ETFs are for retail and institutional investors, while hedge funds are exclusive, less regulated, and focus on absolute returns regardless of market direction.

16. What is systematic risk?

Systematic risk, also called market risk, affects the entire market or a broad asset class and cannot be eliminated through diversification. It arises from factors such as economic recessions, geopolitical instability, inflation, interest rate changes, and natural disasters. This type of risk influences all companies and investments, regardless of their strength or performance. Because it cannot be controlled or reduced, systematic risk is priced into expected investment returns, and investors can only mitigate its impact by adjusting asset allocation or using hedging strategies, never completely avoiding it.

17. How does business risk influence the operating income of the company?

Business risk refers to uncertainties inherent in a company's operations, such as fluctuating demand, competitive pressure, production costs, and regulatory changes. These factors make the company's earnings volatile and unpredictable. When costs unexpectedly rise or sales fall, operating income declines, sometimes creating losses. High business risk industries (e.g., airlines, startups) can see sharp swings in operating profits due to external or internal events, while more stable sectors experience less impact. Effective management, diversified products, and flexible operations can minimize business risk's negative influence on a firm's earnings.

18. What is interest rate risk?

Interest rate risk is the potential for investment losses due to fluctuations in prevailing interest rates. When interest rates rise, the market value of existing bonds and other fixed-income securities falls, since newer issues offer higher yields. Conversely, falling rates increase bond prices. This risk especially affects long-term bonds, as their prices are more sensitive to rate changes. Investors exposed to interest rate risk may see diminished returns if they need to sell securities before maturity. Managing duration and diversifying asset classes are common strategies to mitigate this risk.

19. What is purchasing power risk?

Purchasing power risk, or inflation risk, is the danger that inflation will erode the real value of your investment returns. When prices rise over time, the money you receive from investments—interest, dividends, or capital gains—buys less goods and services. Fixed-income instruments (like bonds or fixed deposits) are most vulnerable, as payouts remain constant despite inflation. To combat this, investors can diversify into equities, real estate, or inflation-indexed bonds, which tend to preserve or grow capital's real value over the long term even as the cost of living increases.

20. Examine how variability in profit increases risk exposure.

Greater variability—or volatility—of profits leads to uncertain cash flows and unpredictability in returns for shareholders. High profit variability makes it harder for companies to plan for growth, service debt, and pay consistent dividends. Investors perceive more risk and may demand higher

returns, raising the cost of capital. In extreme cases, significant year-to-year swings in profit can erode market confidence, causing stock price declines and financial distress. Therefore, stable and predictable earnings are valued, as they reduce perceived risk and exposure to adverse market and operational shocks.

21. How do you diversify the risk?

Diversification reduces investment risk by spreading funds across various asset classes (stocks, bonds, real estate, commodities), industries, and geographic regions. It minimizes unsystematic risk, which is the risk linked to a specific company or sector, by ensuring that losses in one asset or sector can be offset by gains in others. For example, a portfolio investing only in technology stocks faces higher risk compared to one diversified into healthcare, finance, and consumer goods. Geographic diversification reduces exposure to country-specific economic or political events. Proper diversification balances risk and returns, improving portfolio stability over time. It prevents over-reliance on any single asset, protecting investors from sudden shocks affecting particular industries or markets. Effective diversification is a fundamental principle of portfolio management and is considered essential for achieving consistent long-term returns with lower volatility.

22. What are the types of equity shares?

Equity shares represent ownership in a company, entitling shareholders to profits and voting rights. The primary types include ordinary (common) shares and preference shares. Ordinary shares grant voting rights and dividends based on company performance, allowing shareholders to benefit from capital appreciation and dividends; however, they carry higher risk. Preference shares typically offer fixed dividends and have priority over ordinary shares during dividend payments and liquidation but usually lack voting rights. Differential Voting Rights (DVR) shares give unequal voting power, allowing companies to raise capital without diluting control. Bonus shares are additional shares issued to existing shareholders free of cost. Equity shares vary in risk and return profiles, catering to diverse investor needs, from those seeking growth via ordinary shares to more income-focused investors choosing preference shares.

23. Explain in detail the characteristics and types of bonds.

Bonds are debt instruments through which issuers borrow money from investors with a promise to pay periodic interest and repay the principal at maturity. Key characteristics include fixed maturity dates, regular coupon payments, and priority over equity shareholders in claims during liquidation. Bonds provide steady income and relative safety, although market value may fluctuate with interest rate changes. Types of bonds include government bonds (sovereign debt with minimal credit risk), corporate bonds (issued by companies, riskier but higher yield), municipal bonds (issued by local authorities), convertible bonds (can be converted into equity), zero-coupon bonds (sold at discount, no periodic interest), callable bonds (issuer can redeem early), and inflation-linked bonds (adjust returns for inflation). The diversity of bonds allows investors to choose based on their risk appetite, income requirements, and investment horizon.

24. What are various types of debentures?

Debentures are long-term debt instruments issued by companies to raise capital. The main types include secured debentures, backed by company assets as collateral, offering lower risk; unsecured (naked) debentures, without collateral, bearing higher risk and interest rates; convertible debentures, which can convert into equity shares at a predetermined price, providing growth potential alongside fixed income; non-convertible debentures, which cannot convert to equity and offer fixed interest; redeemable debentures, repayable after a certain period; and irredeemable or perpetual debentures, which have no fixed maturity. The choice of debenture depends on investors' risk-return preferences, with secured and convertible types considered safer or more flexible compared to unsecured or perpetual debentures.

25. What are income shares?

Income shares are equity shares issued by companies with a consistent record of paying regular dividends. These shares satisfy investors who seek steady income streams alongside potential for capital gains. Typically, these companies are well-established with stable earnings, enabling predictable dividend payouts, making income shares attractive for risk-averse investors or retirees. Income shares tend to have lower price volatility compared to growth shares, as dividend income offsets

market fluctuations and provides cash flow. By investing in income shares, investors balance the dual objectives of income generation and capital preservation over the long term.

26. What are blue chip shares? Give examples.

Blue chip shares belong to large, well-established, financially sound companies with a history of stable earnings, reliable dividends, and strong market reputation. These shares are considered safer investments due to the issuer's robust business models, leadership positions, and ability to withstand economic downturns. Examples of blue chip companies in India include Reliance Industries, Tata Consultancy Services (TCS), Infosys, and Hindustan Unilever. Investors favor blue chip shares for their stability, moderate growth potential, and consistent dividend income, making them suitable for conservative and long-term investors as foundational holdings in diversified portfolios.

27. What is cyclical share? Give examples.

Cyclical shares represent companies whose performance and stock prices are highly sensitive to economic cycles. Their earnings and valuation tend to rise during periods of economic expansion and decline during recessions. Common sectors include automobiles, steel, construction, and consumer durables. Examples include Tata Motors (automobile), Tata Steel, and Larsen & Toubro (construction). Investing in cyclical shares requires market timing and economic outlook analysis. These shares offer investors the potential for substantial gains during economic booms but come with higher volatility and risk during downturns.

28. What are the essential features of investment?

Investment involves allocation of funds toward assets or projects expecting future returns. Essential features include return (profit or income from investment), risk (uncertainty of returns and potential loss), safety (capital preservation), liquidity (ease of converting investment to cash), marketability (ability to buy/sell easily), and tax efficiency (minimizing tax liabilities). Investments have a trade-off between risk and return, and investors must evaluate their objectives and constraints to select suitable opportunities. Proper investment management balances these features to optimize wealth growth and financial security.

29. Explain the various sources of financial information.

Financial information is vital for informed investment decisions and comes from diverse sources. Primary sources include company annual reports, financial statements, regulatory filings (such as SEC disclosures). Secondary sources include stock exchanges' data releases, business newspapers, financial magazines, and online portals like Bloomberg and Reuters. Analysts' reports, brokerage house publications, and investment advisory services offer expert opinions and analysis. Government publications provide macroeconomic data. Investor education websites and company websites also help. Accessing multiple sources ensures comprehensive information and mitigates risks of misinformation or partial data.

30. Define portfolio construction.

Portfolio construction involves selecting and combining various financial assets to achieve desired investment goals while managing risk. It requires asset allocation decisions based on investor profile, risk tolerance, time horizon, and return expectations. Portfolio managers decide the mix of equities, bonds, cash, and alternative investments to optimize returns while minimizing risk through diversification. The process includes continuous monitoring and periodic rebalancing to adjust for market fluctuations and changing investor needs. Effective portfolio construction balances safety, liquidity, and growth opportunities aligned with investor objectives.

31. Define and discuss portfolio performance measurement.

Portfolio performance measurement assesses returns generated versus risk taken over a period. Key metrics include total return, risk-adjusted return measures like Sharpe ratio (return per unit of risk), Treynor ratio (return per systematic risk), Jensen's alpha (excess returns above expected CAPM returns), and beta (volatility relative to the market). Comparing portfolio returns with benchmark indices helps gauge relative performance. Performance evaluation guides asset allocation adjustments, risk management, and manager accountability, ensuring investment goals are met efficiently.

32. Explain the charting technique of technical analysis.

Charting in technical analysis involves plotting historical price and volume data in graphical formats—line charts, bar charts, and candlestick charts—to identify price patterns and trends. Traders analyze support and

resistance levels, moving averages, and indicators such as RSI or MACD to forecast potential price movements. Charting helps in timing entries, exits, and understanding market sentiment. It assumes that historical price behavior patterns tend to repeat, aiding decision-making without focusing on underlying company fundamentals.

33. What is the difference between technical analysis and fundamental analysis?

Technical analysis studies past market data like price and volume using charts and indicators to forecast future price movements based on patterns and trends. It focuses on trading timing and investor behavior. Fundamental analysis evaluates a company's intrinsic value through financial statements, management quality, industry conditions, and economic factors, guiding long-term investment decisions. While technical analysis uses price action, fundamental analysis employs business and economic data to assess security value.

34. What is meant by fundamental analysis?

Fundamental analysis is the process of evaluating a security's intrinsic value by studying related economic, financial, and qualitative factors. This involves analyzing financial statements (like balance sheets, income statements, cash flow), management effectiveness, industry trends, and overall economic conditions to estimate if a security is undervalued or overvalued by the market. Unlike technical analysis that focuses on price and volume patterns, fundamental analysis seeks to determine a company's real worth and long-term prospects. Investors use this method to select undervalued stocks for long-term investment, aiming to benefit from future price corrections. It's commonly used for stock selection and can be applied to bonds or other assets by evaluating issuer credibility, earnings potential, and future growth. Key ratios such as PE (Price to Earnings), ROE (Return on Equity), and debt-to-equity are central tools in this approach, helping investors make informed decisions.

35. Discuss any four important factors in appraising companies in different industries.

When appraising companies, investors should examine:

Revenue Growth: A consistent rise in sales over the years signals expanding market reach and robust business operations, indicating potential.

Profitability: Margins such as operating and net profit reflect efficiency and cost management. Healthy margins generally enable firms to weather downturns.

Competitive Position: Market share and brand strength indicate a company's capacity to dominate or withstand competition within its sector; leaders tend to perform better long-term.

Management Quality: Experienced, innovative, and ethical management can drive sustainable success, effective strategy execution, and superior returns.

Additional factors include industry trends, capital structure, governance, and regulatory environment. Thorough evaluation across these factors helps investors gauge risk and identify companies with strong prospects for stable returns and growth.

36. How does technical analysis differ from fundamental analysis?

Technical analysis and fundamental analysis are two primary approaches for assessing securities. Technical analysis involves studying historical price and volume data, chart patterns, and technical indicators to predict future price trends and trading opportunities. It assumes that all information is already reflected in the stock price and focuses primarily on timing. In contrast, fundamental analysis dives into a company's financial statements, management quality, industry position, and macroeconomic factors to determine its intrinsic value and long-term growth prospects. While technical analysts are more concerned with 'when' to buy or sell, fundamental analysts emphasize 'what' to buy, aiming for value investing over longer horizons.

37. How do stock prices have support and resistance levels?

Support and resistance are key concepts in technical analysis. A support level is a price at which a stock consistently finds buying interest, preventing the price from falling lower due to increased demand. Resistance is a price level where selling intensifies, halting upward movement because supply exceeds demand. These levels are identified by analyzing past price behavior, where prices have repeatedly reversed direction. Support suggests a "floor" for stock prices, while resistance acts as a "ceiling." Traders use these levels to time entry and exit points, set stop-losses, and estimate price targets in short-term trading strategies.

Breaching these levels may signal a new trend, such as a breakout or breakdown, and help guide trading decisions.

38. Analyse - ‘Moving averages not only smoothen data, but predict the market’

Moving averages are statistical tools that average a security’s price over a specified period, reducing short-term volatility and filtering out market noise. By plotting moving averages on charts, investors identify underlying trends more easily. When short-term moving averages cross above long-term ones, it signals potential upward momentum, while the reverse often forecasts declines—these crossover points act as predictive signals for buying or selling. Moving averages help confirm trend direction and strength. They also serve as dynamic support or resistance levels. While not foolproof, moving averages are widely used for trend-following strategies and as early warning tools for market reversals.

39. Evaluate - ‘Oscillators are valuable tools in assessing the overbought and oversold position of the market’.

Oscillators are technical indicators—such as the Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), and Stochastic Oscillator—that oscillate within a set range to signal momentum and potential price reversals. These tools identify overbought conditions (where prices may be excessively high and likely to fall) or oversold situations (where prices are unusually low and due for a bounce). Oscillators aid traders in timing entries and exits by highlighting when assets deviate from their normal trading range or trend, increasing the probability of profitable trades. However, oscillators work best in range-bound or sideways markets rather than strong trends, and are often combined with other technical tools for accuracy.

40. What is meant by odd lot trading?

Odd lot trading refers to buying or selling securities in quantities that are less than the standard trading unit, usually 100 shares in stock exchanges. These non-standard lots, known as "odd lots," are contrasted with "round lots" (multiples of 100 shares). Odd lot trading was traditionally performed by small or retail investors who couldn’t afford round lots. Although technology has made any quantity tradable today, odd lot trades may still have wider bid-ask spreads and slightly higher transactional costs. Sometimes, market trends in odd lot activity are considered

indicators of retail investor sentiment. Odd lot trading offers flexibility, allowing investors to invest amounts that suit their individual budgets.

41. How do volume and breadth of the market indicate the trend of the market?

Volume and breadth are crucial technical indicators that confirm market trends and strength. Volume measures the total number of shares traded and indicates the intensity of buying or selling. High volume accompanying price movement suggests strong conviction behind the trend, making it more sustainable. Market breadth refers to the number of advancing versus declining stocks in the market. If more stocks rise than fall (positive breadth), it reflects broad market participation and supports a bull trend, while negative breadth signals weakness or potential reversal. Combining these signals helps investors and analysts validate the sustainability of rallies or declines, enhancing timing and decision making.

42. Explain the concept of Economic analysis for investment decision

Economic analysis involves studying macroeconomic indicators such as GDP growth, inflation, interest rates, employment, fiscal and monetary policies, and global economic trends to assess their impact on markets and investments. By understanding how these factors influence overall economic health, investors can forecast which sectors or industries may thrive or struggle, aiding strategic asset allocation. For example, lower interest rates often boost stock and real estate markets, while high inflation may benefit commodities. Systematic economic analysis allows investors to anticipate market cycles, manage risk, and allocate resources to maximize returns, forming the foundation for a top-down investment approach.

43. What are the stages in industry lifecycle? Explain the significance of this concept to an investor.

The industry lifecycle consists of four stages: Introduction (emerging industries with rapid growth, high risk); Growth (expansion, increased revenues, rising profits, growing competition); Maturity (stable, slower growth, consolidation); and Decline (falling demand, shrinking profits). Understanding where an industry fits on this cycle helps investors make informed decisions—early-stage industries offer high growth but greater risk, while mature industries provide stability and regular dividends. Investing with lifecycle awareness improves timing, portfolio

diversification, and return potential, allowing investors to exploit growth opportunities or avoid declining sectors, ultimately optimizing portfolio performance.

44. Explain top–down approach.

The top-down approach to investing begins with an analysis of the macroeconomic environment, focusing on broad economic indicators like GDP growth, interest rates, inflation, and fiscal policies. From there, it narrows down to analyzing specific industries or sectors expected to outperform based on economic trends. Finally, investors select individual companies within those promising industries. This approach emphasizes the importance of understanding economic cycles and industry conditions to identify where capital can be most effectively deployed. It's a popular strategy for macro investors and portfolio managers seeking to reduce risk and enhance returns by aligning investments with prevailing economic trends. It contrasts with the bottom-up approach, which focuses on company fundamentals without emphasizing macro or sector factors.

45. What are the economy-wide factors that affect the fundamental analysis?

Economy-wide factors affecting fundamental analysis include inflation rates, which impact purchasing power and cost structures; interest rates, influencing borrowing costs and discount rates; economic growth (GDP), indicating demand and business conditions; fiscal and monetary policies shaping the business environment; exchange rates affecting international trade and earnings; political stability, impacting investor confidence; and external shocks like geopolitical events or natural disasters. These factors influence company earnings, valuations, and market sentiment, making their analysis crucial in assessing intrinsic security value. Ignoring macroeconomic factors can result in mispricing and suboptimal investment decisions.

46. What is security market line?

The Security Market Line (SML) graphically represents the Capital Asset Pricing Model (CAPM) relationship between expected return and systematic risk (beta). It plots the expected return of assets as a function of their beta, showing that higher risk, measured by beta, demands higher expected returns. The SML intercept is the risk-free rate, and its slope represents the market risk premium. Assets plotted above the SML are

undervalued (offering higher return for their risk), and those below are overvalued. The SML is used to evaluate asset pricing and investment performance relative to risk.

47. What is meant by arbitrage?

Arbitrage is the simultaneous purchase and sale of an asset in different markets to exploit price differences, earning a risk-free profit. It ensures market efficiency by correcting price discrepancies across exchanges or geographies. For instance, if gold trades cheaper in one country than another, arbitrageurs buy where cheaper and sell where expensive, stabilizing prices across markets. Arbitrage opportunities are typically short-lived as market forces quickly eliminate differences. It requires speed, capital, and access to multiple markets, and contributes to liquidity and price efficiency.

48. Distinguish between the security market line and capital market line.

The Security Market Line (SML) represents the expected return versus systematic risk (beta) for individual assets within CAPM. It measures risk based on sensitivity to market movements. The Capital Market Line (CML), however, describes the risk-return trade-off for efficient portfolios, measuring overall risk by total standard deviation (volatility), combining systematic and unsystematic risk. CML plots expected portfolio return against standard deviation, identifying optimal portfolios with best risk-return combinations. SML focuses on individual asset pricing, while CML addresses portfolios, emphasizing diversification benefits.

49. How is standard deviation used in risk assessment?

Standard deviation measures the variability or dispersion of investment returns around the mean return. A higher standard deviation implies greater volatility and unpredictability of returns, indicating higher investment risk. It is widely used in portfolio and risk management to quantify historical performance deviations and forecast potential future variability. For example, a stock with a 20% standard deviation is considered riskier than one with 10%. Standard deviation helps investors gauge how much an investment's returns fluctuate and assists in constructing portfolios that align with risk tolerances.

50. What is Risk free asset?

A risk-free asset is an investment that offers a guaranteed return with no chance of financial loss, serving as the benchmark in finance models. Theoretically, government securities like Treasury bills (T-bills) are considered risk-free as they are backed by the government's credit. Risk-free assets are used in portfolio construction and CAPM as the base for calculating risk premiums, helping investors understand trade-offs between risk and return. While truly risk-free assets may not exist in reality, these government-backed instruments are accepted proxies due to their minimal default and volatility risk.

51. Define the various forms of market efficiency. What do they have in common?

Market efficiency refers to how well market prices reflect available information. There are three forms:

Weak form: Prices reflect all historical price data. Past prices cannot predict future prices.

Semi-strong form: Prices reflect all publicly available information, including financial statements, news, and announcements. Only insider information can provide an advantage.

Strong form: Prices incorporate all information, public and private (including insider knowledge), so no one can consistently achieve abnormal returns.

All forms share the assumption that markets quickly and accurately incorporate information into prices, ensuring investors receive fair prices reflecting risks and returns. The concept underpins the Efficient Market Hypothesis, emphasizing that opportunities for consistent excess returns through stock picking or market timing are limited.

52. What are the characteristics of Security Market Line?

The Security Market Line (SML) graphically represents the relationship between an asset's expected return and its systematic risk (beta). Key characteristics include:

It is a straight line starting at the risk-free rate.

Its slope is the market risk premium (expected market return minus risk-free rate).

Assets plotting above the line are undervalued offering more return per risk; below the line are overvalued.

It is used in CAPM to assess whether a security offers a fair expected return based on its beta.

It helps investors identify fairly priced, undervalued, or overvalued securities for portfolio decisions.

53. Explain the history of behavioral finance.

Behavioral finance emerged in the late 20th century, blending psychology with economics to challenge traditional finance assumptions of rational investor behavior. Researchers like Daniel Kahneman and Amos Tversky demonstrated that investors often act irrationally due to biases such as overconfidence, loss aversion, and herd behavior. Behavioral finance explains market anomalies like bubbles, crashes, and inefficiencies unexplainable by classical theories. It highlights how emotions and cognitive errors impact financial decisions, helping develop better investment strategies and risk management approaches by understanding real-world investor behavior beyond purely mathematical models.

54. What is behavioral finance? Explain its importance in investment scenario.

Behavioral finance studies psychological influences on investors' decisions and market outcomes. It identifies cognitive biases (overconfidence, anchoring), emotional factors (fear, greed), and social influences (herding) that cause investors to deviate from rationality presumed by traditional finance. Recognizing these behaviors explains market anomalies and inefficiencies like bubbles and crashes. In investment scenarios, behavioral finance helps managers design better strategies, advisors improve client outcomes, and investors avoid common mistakes. It complements fundamental and technical analyses by accounting for human factors impacting price movements, enhancing risk management, portfolio construction, and decision-making processes.

55. What is an efficient market?

An efficient market is one where security prices quickly and fully reflect all relevant and available information. In such markets, it is impossible to consistently achieve returns exceeding average market returns on a risk-adjusted basis through stock selection or market timing. The Efficient Market Hypothesis (EMH) states that prices incorporate information from all sources—public, past, and insider in strong form—ensuring fair valuation. Efficient markets promote liquidity, transparency, and optimal

capital allocation, but also imply that beating the market consistently is unlikely without taking extra risk.

56. What is random walk theory?

The Random Walk Theory posits that stock prices follow a random and unpredictable path, influenced by new information appearing at random. It suggests that past price movements or trends cannot reliably predict future prices because all available information is already reflected in current prices. Consequently, attempts to time the market or identify patterns yield no consistent advantage. The theory supports the idea of efficient markets where prices fully reflect information instantaneously, advocating passive investment strategies like index funds over active trading.

57. Define capital Asset pricing model. Bring out its basic assumptions.

The Capital Asset Pricing Model (CAPM) estimates the expected return of an asset based on its systematic risk relative to the market. It states that $\text{Expected Return} = \text{Risk-Free Rate} + \beta \times (\text{Market Return} - \text{Risk-Free Rate})$. Key assumptions include: investors are rational and risk-averse, markets are efficient with no transaction costs, single investment period, all investors have homogenous expectations, and they can borrow and lend at risk-free rates. CAPM aids in asset pricing, portfolio management, and cost of capital estimation.

58. Explain Random Walk theory.

See question 56.

59. Discuss Markowitz Portfolio theory.

Markowitz's Portfolio Theory advocates diversification to maximize expected return for a given risk level or minimize risk for a given return. It considers portfolio risk as a function of individual asset risks and their correlations, emphasizing that combining assets reduces total portfolio risk if returns are not perfectly correlated. The theory introduced the efficient frontier—the set of optimal portfolios offering the best possible return-risk trade-offs. It is the foundation of modern portfolio management and risk diversification strategies.

60. How do you find portfolio risk and return?

Portfolio return is the weighted average of the expected returns of individual assets. Portfolio risk (variance or standard deviation) considers asset volatilities and correlations. Formally, portfolio variance is

$$\sigma_p^2 = \sum w_i^2 \sigma_i^2 + \sum \sum w_i w_j \sigma_i \sigma_j \rho_{ij}$$

where

$w_i w_j$ are weights,

$\sigma_i \sigma_j$ are asset standard deviations, and

ρ_{ij} are correlations. This accounts for diversification; risk usually is less than the weighted sum of individual risks due to imperfect correlation.

61. Compare systematic risk with unsystematic risk.

Systematic risk, also known as market risk, affects the entire market or a broad segment and cannot be eliminated through diversification. Examples include interest rate changes, inflation, recessions, and geopolitical events. It impacts nearly all investments, influencing overall market returns. Unsystematic risk, or specific risk, originates from factors unique to a company or industry, such as management decisions, labor strikes, or product recalls. This risk can be reduced or eliminated by diversifying investments across different companies and sectors. Investors typically seek to manage unsystematic risk via diversification, while accepting systematic risk as inherent in market investing.

62. Compare active portfolio with passive portfolio management.

Active portfolio management involves frequent buying and selling of securities, aiming to outperform market benchmarks through research, market forecasts, and timing. It requires expertise and typically incurs higher management fees and transaction costs. Passive portfolio management involves replicating a market index or benchmark by holding securities in the same proportion as the index, aiming for market returns with minimal trading. It offers lower costs, less risk of management errors, and tax efficiency. Passive management suits investors seeking steady, market-matching returns, while active management appeals to those pursuing potential outperformance despite higher risks and costs.

63. What are the techniques of portfolio performance measures?

Common techniques include:

Sharpe Ratio, measuring excess return per unit of total risk (standard deviation).

Treynor Ratio, assessing returns relative to systematic risk (beta).

Jensen's Alpha, indicating returns above CAPM predictions.

Information Ratio, measuring active return against tracking error.

Benchmark Comparison, evaluating performance relative to market indices. These metrics help investors and managers assess risk-adjusted returns, understand portfolio efficiency, and guide decision-making to optimize investment outcomes.

64. Determine the importance of portfolio revision.

Portfolio revision ensures alignment with changing market conditions, risk tolerance, and investment objectives. Over time, asset values fluctuate, potentially skewing target allocations and increasing unintended risk. Regular revision involves rebalancing to maintain desired risk-return profiles, harvesting profits, and replacing underperforming assets. It helps capitalize on new opportunities, manage emerging risks, and adapt to life changes or financial goals. Neglecting revision can lead to overexposure to riskier assets or missed growth prospects. Dynamic portfolio management through periodic revision is essential for optimizing long-term returns and mitigating losses.

65. Discuss the benefits of portfolio diversification.

Diversification spreads investments across asset classes, sectors, and geographies to reduce unsystematic risk. It lowers volatility by ensuring that negative performance in one area is balanced by gains elsewhere, stabilizing returns. By minimizing exposure to individual company or industry risks, diversification reduces the likelihood of significant losses. It enhances risk-adjusted returns, allowing investors to achieve desired objectives with lower risk. Additionally, diversification offers flexible investment strategies and better alignment with financial goals and risk tolerance, improving portfolio resilience against market shocks and economic uncertainties.

66. Explain Sharpe's technique in portfolio evaluation.

The Sharpe ratio, developed by William Sharpe, measures risk-adjusted portfolio performance. It is the ratio of the portfolio's excess return (portfolio return minus risk-free rate) to its standard deviation (total risk). A higher Sharpe ratio means the portfolio is generating more return per unit of risk taken, indicating superior risk-adjusted performance. It helps investors compare different portfolios or funds regardless of their risk levels. Sharpe's technique encourages selecting investments that maximize returns without disproportionately increasing risk. It is widely used in

portfolio management to evaluate whether returns compensate for the amount of risk borne and to optimize asset allocation.

67. Justify - mutual funds offer best form of investment.

Mutual funds provide diversification by pooling money and investing in a variety of securities, reducing individual risk. They offer professional management by experts who conduct detailed research and make investment decisions. Mutual funds are accessible to investors with limited capital due to low minimum investment requirements. They provide liquidity, allowing investors to buy or sell units easily at Net Asset Value. Transparent operation and regulation by authorities protect investors. Additionally, mutual funds come in various types catering to different risk appetites and investment goals, making them versatile investment vehicles suitable for most investors.

68. Evaluate “higher the return, higher would be the risk”. In this context, discuss the various risks associated with portfolio planning.

The principle implies that seeking higher returns requires accepting greater risk. Portfolio planning balances these trade-offs to align with investor risk tolerance. Risks include market risk (price fluctuations), credit risk (issuer default), interest rate risk (bond price changes), liquidity risk (difficulty selling assets), and inflation risk (erosion of purchasing power). Higher-return assets like stocks have higher volatility, while bonds are more stable but offer lower returns. Effective portfolio planning diversifies across asset classes and securities to manage these risks while pursuing optimal returns consistent with investor objectives.

69. What are the objectives and basic principles of wealth management?

Wealth management aims to preserve and grow an individual’s financial resources to meet long-term goals such as retirement, education, and estate planning. Objectives include capital preservation, income generation, tax efficiency, and risk management. Basic principles involve understanding client goals, diversification, disciplined investing, regular portfolio review, and adapting strategies according to life changes and market conditions. Wealth management integrates financial planning, asset allocation, tax planning, and investment management, ensuring holistic financial well-being.

70. Distinguish constant rupee plan from constant ratio plan.

The constant rupee plan maintains a fixed rupee amount invested in a particular asset, such as equity or bonds, regardless of market fluctuations. This approach requires periodic buying or selling to keep the invested amount constant, promoting systematic investment and rebalancing. The constant ratio plan maintains a fixed percentage allocation between two or more asset classes, like 60% equity and 40% debt. When asset values change, the portfolio is rebalanced to restore these proportions, managing risk and ensuring alignment with asset allocation strategy. The main difference is rupee plan fixes absolute amount; ratio plan fixes relative proportion.

71. Define formula plans.

Formula plans are systematic portfolio management strategies that set predetermined rules for asset allocation and rebalancing. Common types include the Constant Rupee Plan, where a fixed monetary amount is invested regularly in a particular asset regardless of market price; the Constant Ratio Plan, maintaining a fixed proportion between asset classes by periodic buying and selling; and the Variable Ratio Plan, which adjusts asset allocation ratios depending on market conditions or investor risk tolerance. Formula plans promote disciplined investing, reduce emotional decision-making, allow for rupee-cost averaging, and help manage risk by maintaining desired portfolio balance over time. These plans simplify portfolio management by providing clear rules, making them suitable for retail investors seeking structured investment approaches.

72. Risk free rate is 7%. The market risk premium is 10.5% and the Beta of the security is 1.5. Calculate the expected return of the security under CAPM.

Using CAPM formula:

$$\begin{aligned}\text{Expected Return} &= \text{Risk-Free Rate} + \text{Beta} \times \text{Market Risk Premium} \\ &= 7\% + 1.5 \times 10.5\% \\ &= 7\% + 15.75\% \\ &= 22.75\%\end{aligned}$$

Therefore, the expected return on the security is 22.75%. This high return reflects the security's higher systematic risk as it has a beta greater than 1, indicating it is more volatile than the overall market. Investors demand

this higher return as compensation for taking on extra risk compared to the risk-free asset.

73. Justify - “Investment in Mutual funds are better than equity shares.”

Investing in mutual funds reduces risk through diversification across multiple securities, unlike investing in a few individual equity shares. Mutual funds provide professional management, ensuring better research, monitoring, and timely decisions by experts. They offer liquidity, allowing investors to buy or redeem shares easily. Entry barriers are low, making them accessible for small investors. Mutual funds also provide various fund types suited to risk profiles and goals. For inexperienced investors, mutual funds reduce complexity and emotional biases associated with individual stock selection. This combination of diversification, expertise, and convenience makes mutual funds a safer and more effective investment avenue than direct equity shares.

74. A stock has a required rate of return of 11% as per CAPM. Market return = 10% and risk-free return = 5%. Calculate Beta and state whether the stock is defensive or aggressive.

Using CAPM formula:

Required Return = Risk-Free Rate + Beta × (Market Return – Risk-Free Rate)

$$11\% = 5\% + \text{Beta} \times (10\% - 5\%)$$

$$11\% - 5\% = \text{Beta} \times 5\%$$

$$6\% = \text{Beta} \times 5\%$$

$$\text{Beta} = 6\% / 5\% = 1.2$$

A beta greater than 1 indicates the stock is more volatile than the market, making it an aggressive stock. It is expected to amplify market movements, with higher potential gains and higher risk.

LONG QUESTION AND ANSWERS

1. Examine the economic and financial meaning of investment. In the stock market, differentiate the investor from the speculator.

- Economic Definition of Investment
- Financial Definition of Investment
- Purpose of Investment

- Characteristics of an Investor
- Characteristics of a Speculator
- Time Horizon Differences
- Risk Tolerance Variation
- Decision-Making Process
- Expected Outcome Differences
- Impact on Market Stability

2. Explain in detail the criteria used to evaluate various investment avenues.

- Safety of Principal
- Liquidity of Investment
- Expected Return
- Risk Associated
- Marketability
- Tax Implications
- Investment Horizon
- Cost and Expenses
- Historical Performance
- Regulatory Environment

3. Discuss about securities with moderate to high risk.

Equity Shares

- Corporate Bonds with Lower Credit Ratings
- Mutual Funds with Aggressive Objectives
- Derivatives and Futures
- High-Yield Bonds (Junk Bonds)
- Convertible Securities
- Real Estate Investment Trusts (REITs)
- Venture Capital Investments
- Emerging Market Securities
- Commodities and Precious Metals

4. Discuss investment triangle based on three compromising objectives.

Safety

- Liquidity

- Growth
- Trade-offs Between Objectives
- Examples of Investments in Each Corner
- Balancing Strategies
- Impact of Investor Goals
- Portfolio Implications
- Role in Asset Allocation
- Decision-Making Framework

5. Explain mutual funds? Briefly outline criteria for selection of mutual funds.

Definition of Mutual Funds

- Types of Mutual Funds
- Fund Objectives
- Past Performance Analysis
- Expense Ratio Consideration
- Fund Manager Expertise
- Portfolio Diversification
- Risk-Return Profile
- Liquidity of Fund
- Alignment with Investor Goals

6. Discuss the advantages of investing in life insurance schemes?

Financial Security and Protection

Savings and Wealth Creation

- Tax Benefits
- Loan Facility Against Policy
- Disciplined Investment Approach
- Risk Coverage
- Flexibility of Terms
- Legacy Planning
- Guaranteed Returns on Some Schemes
- Psychological Assurance to Investors

7. Explain why do investors add real estate in their portfolio?

- Diversification Benefits
- Inflation Hedge
- Capital Appreciation Potential
- Steady Rental Income
- Tangible Asset Ownership
- Portfolio Risk Reduction
- Tax Advantages
- Leverage Opportunities
- Long-Term Wealth Creation
- Low Correlation with Financial Markets

8. Summarize on various features of investment programme.

- Clearly Defined Objectives
- Risk Assessment and Management
- Diversification Strategy
- Asset Allocation Plans
- Periodic Review and Rebalancing
- Cost Efficiency Focus
- Regulatory Compliance
- Time Horizon Consideration
- Performance Measurement
- Investor Education

9. Elaborate on various investment avenues available for investors in India.

- Equity Shares
- Mutual Funds
- Fixed Deposits
- Government Securities
- Real Estate
- Gold and Precious Metals
- Public Provident Fund
- National Savings Certificates
- Corporate Bonds

- Derivatives

10. Discuss about investment and objectives of investment.

- Definition of Investment
- Preservation of Capital
- Income Generation
- Capital Appreciation
- Liquidity Requirements
- Tax Benefits

- Risk Management
- Inflation Protection
- Diversification
- Financial Goals Alignment

11. Discuss how market risk influences the capital market using real life examples.

- Definition of Market Risk
- Economic Recessions
- Interest Rate Changes
- Political Instability
- Global Events Impact
- Market Volatility
- Sectoral Impacts
- Investor Sentiment
- Effects on Asset Prices
- Risk Management

12. Elaborate unsystematic risk and also describe all of them with examples.

- Definition of Unsystematic Risk
- Business Risk
- Financial Risk
- Operational Risk
- Regulatory Risk

- Event Risk
- Diversification to Mitigate
- Examples for Each
- Company-specific Factors
- Impact on Returns

13. Distinguish between systematic and unsystematic risk.

Systematic Risk Definition

- Unsystematic Risk Definition
- Market-wide vs. Company-specific
- Diversifiability
- Examples of Each
- Impact on Portfolio
- Measurement and Management
- Risk Premiums
- Investor Considerations
- Tools for Reduction

14. Assess the ways in which would you minimize various risk exposures?

- Diversification
- Asset Allocation
- Hedging Techniques
- Stop Loss and Limits
- Insurance Products
- Fundamental Analysis
- Technical Analysis
- Risk Assessment Tools
- Monitoring and Rebalancing
- Professional Advice

15. Explain the statistical tools used to measure the risk of securities return?

- Standard Deviation
- Variance

- Beta
- Coefficient of Variation
- Value at Risk (VaR)
- Correlation Coefficient
- Sharpe Ratio
- Treynor Ratio
- Jensen's Alpha
- Tracking Error

16. Explain in detail strategies available for the investors to minimize risk exposure.

- Portfolio Diversification
- Asset Allocation
- Investment in Risk-Free Assets
- Hedging with Derivatives
- Use of Stop Loss Orders
- Regular Portfolio Review
- Dollar Cost Averaging
- Investing in Blue Chip Stocks
- Avoiding Overconcentration
- Managing Market Timing

17. Discuss all the risk exposures of investment.

- Market Risk
- Credit Risk
- Liquidity Risk
- Operational Risk
- Inflation Risk
- Interest Rate Risk
- Exchange Rate Risk
- Political Risk
- Reinvestment Risk
- Legal and Regulatory Risk

18. Mr. Jitendra gives you an estimate of possible returns from a security and their probability. Calculate the expected return.

- Listing Probabilities and Returns
- Formula for Expected Return
- Stepwise Calculation
- Interpretation
- Use in Decision-Making

- Role in Portfolio Theory
- Impact on Risk Assessment
- Probabilistic Forecasting
- Assumptions
- Limitations

19. Mr. Rajendra holds shares in Varun Ltd. Estimate possible return and their probability given. Calculate expected return and standard deviation.

- Returns and Probabilities Table
- Expected Return Calculation
- Standard Deviation Formula
- Variance Calculation
- Risk Estimation
- Interpretation of Results
- Importance in Portfolio Management
- Use in Investment Decisions
- Graphical Representation Possible
- Limitations

20. The following investment opportunities are available to Mr. Shankar ... Discuss whether combining the securities in 50:50 proportion would be advantageous.

- Description of Security A and B
- Expected Returns and Risks
- Portfolio Return Calculation
- Portfolio Risk Calculation
- Benefits of Diversification

- Correlation Impact
- Risk-Return Tradeoff
- Investment Suitability
- Scenario Analysis

- Managerial Implications

21. Analyse how does ratio analysis reflect the health of the company?

- Definition of Ratio Analysis
- Profitability Ratios
- Liquidity Ratios
- Leverage Ratios
- Efficiency Ratios
- Market Ratios
- Trend Analysis
- Peer Comparison
- Early Warning Signals
- Decision-Making Utility

22. Examine why is industry analysis important? Why it follows the economic analysis?

- Importance of Industry Analysis
- Industry Life Cycle Stages
- Competitive Structure
- Growth Prospects
- Regulatory Environment
- Profitability Drivers
- Inter-Industry Comparisons
- Impact on Investment Choice
- Sequencing with Economic Analysis
- Strategic Positioning

23. Explain how does competitive position of the company within an industry determined?

- Market Share Assessment

- Cost Leadership
 - Product Differentiation
 - Economies of Scale
 - Branding and Customer Loyalty
-
- Distribution Network
 - Innovation Capability
 - Barriers to Entry
 - Management Expertise
 - Relative Financial Strength

24. Explain in detail Dow Theory and how it is used to determine the direction of stock market?

- Introduction to Dow Theory
- Major Principles
- Market Trends (Primary, Secondary, Minor)
- Confirmation by Averages
- Volume Analysis
- Support and Resistance Levels
- Buy/Sell Signals
- Interpretation of Patterns
- Application in Market Analysis
- Criticisms

25. Illustrate how chart patterns are helpful in predicting the stock price movement.

- Types of Chart Patterns
- Continuation Patterns
- Reversal Patterns
- Support and Resistance
- Breakouts and Pullbacks
- Volume Confirmation
- Pattern Duration
- Probability of Success

- Integration with Indicators
- Limitations and Risks

26. Explain point and figure chart, and how it is used?

- Definition of Point and Figure Chart
- Construction Rules
- X and O Columns
- Box Size and Reversal Criteria
- Identifying Trends
- Price Targets
- Support and Resistance
- Buy and Sell Signals
- Advantages
- Limitations

27. Explain the various charting techniques in technical analysis.

- Line Charts
- Bar Charts
- Candlestick Charts
- Point and Figure Charts
- Renko Charts
- Heikin-Ashi Charts
- Volume Charts
- Relative Strength Charts
- Multiple Time Frames
- Patterns and Indicators Integration

28. Discuss the meaning of Company Analysis. What are the factors would you look in for analysis for a particular company?

- Definition of Company Analysis
- Financial Statement Analysis
- Earnings Growth
- Management Competence
- Industry Position

- Competitive Advantage
- Dividend Policy
- Debt Structure
- Governance Practices
- Product Portfolio
- Future Prospects

29. Discuss the common tools in technical analysis

- Moving Averages
- Relative Strength Index (RSI)
- Moving Average Convergence Divergence (MACD)
- Bollinger Bands
- Stochastic Oscillator
- Fibonacci Retracement
- On-Balance Volume
- Support and Resistance
- Trendlines
- Chart Patterns

30. Elaborate technical analysis and various technical indicators used to predict the direction of the market.

- Definition of Technical Analysis
- Assumptions of Technical Analysis
- Trend Analysis
- Chart Patterns
- Oscillators
- Momentum Indicators
- Volume Analysis
- Moving Averages
- Support and Resistance
- Composite Indicators

31. Explain in detail about random walk theory?

- Definition of Random Walk Theory

- Assumptions of the Theory
- Market Price Behavior
- Implications for Market Predictability
- Relation to Efficient Market Hypothesis
- Impact on Investment Strategies
- Criticisms of the Theory
- Empirical Evidence
- Role in Passive Investing
- Limitations

32. Illustrate how do you calculate Beta of a stock?

Definition of Beta

Beta (β) measures a stock's volatility relative to the overall market. It quantifies systematic risk, showing how much the stock's price moves compared to market movements.

Formula for Beta Calculation

$\beta = \text{Covariance}(\text{Stock Returns, Market Returns}) / \text{Variance}(\text{Market Returns})$

Regression Analysis Approach

Regression involves plotting stock returns (dependent variable) against market returns (independent variable). Beta is the slope coefficient of the resulting regression line.

Covariance and Variance Calculation

Covariance measures how stock and market returns move together, while variance measures the spread of market returns.

Interpretation of Beta Values

$\beta = 1$: stock moves in line with the market

$\beta > 1$: more volatile (aggressive)

$\beta < 1$: less volatile (defensive)

$\beta < 0$: moves inversely to market

Beta Greater than 1 (Aggressive Stock)

Such stocks amplify market movements, offering potentially higher returns but increased risk.

Beta Less than 1 (Defensive Stock)

These stocks are less sensitive to market movements, providing stability and lower risk.

Data Sources Used

Historical stock prices and market index returns over specific periods (daily, weekly, monthly).

Applications in Portfolio Management

Beta helps in portfolio diversification and risk management by selecting stocks with varying betas.

Limitations of Beta

Beta is based on historical data, assumes linear relationship, may ignore market anomalies, and is affected by time frame and market conditions

33. Elaborate the types of tests that have been commonly employed to verify the weak form of efficient market hypothesis

- Overview of Weak Form EMH
- Serial Correlation Test
- Runs Test
- Filter Rules Test
- Technical Trading Rules Test
- Event Study Approach
- Empirical Findings
- Limitations of Tests
- Implications for Investors
- Market Efficiency Conclusions

34. Discuss the results of the studies that support the semi-strong form of EMH?

- Definition of Semi-Strong EMH
- Event Studies on Earnings Announcements
- Stock Split Effects
- Dividend Announcement Studies
- Market Reaction Speed
- Insider Information Distinction
- Empirical Support
- Statistical Significance
- Impact on Fundamental Analysis
- Challenges

35. Analyse the evidences that support EMH theory?

- Different Forms of EMH
- Empirical Tests Summary
- Stock Price Adjustment Speed
- Lack of Predictability in Returns
- Passive vs Active Fund Performance
- Market Anomalies and Exceptions
- Behavioral Finance Contradictions
- Global Market Studies
- Implications for Investors
- Policy making

36. Explain the arguments raised against the EMH theory?

- Market Anomalies
- Behavioral Finance Insights
- Overreaction and Underreaction
- Excess Volatility
- Role of Investor Psychology
- Limits to Arbitrage
- Insider Trading Evidence
- Empirical Contradictions
- Speculative Bubbles
- Practical Investment Strategies

37. Discuss capital asset pricing model.

- CAPM Definition
- Formula and Components
- Assumptions of CAPM
- Expected Return Calculation
- Role of Beta
- Risk-Free Rate and Market Risk Premium
- Applications in Portfolio Management
- Limitations and Criticism
- Extensions and Alternatives

- Practical Use

38. Assess Optimal risky portfolio

- Definition of Optimal Risky Portfolio
- Efficient Frontier
- Capital Market Line (CML)
- Risk-Return Tradeoff
- Portfolio Weights Determination
- Role of Risk-Free Asset
- Expected Return and Volatility
- Sharpe Ratio Maximization
- Utility Maximization
- Practical Considerations

39. Examine the three forms of market efficiency and its implications.

- Weak Form Efficiency
- Semi-Strong Form Efficiency
- Strong Form Efficiency
- Information Reflection in Prices
- Implications for Trading Strategies
- Impact on Technical Analysis
- Impact on Fundamental Analysis
- Market Anomalies
- Role of Insider Information
- Investment Decision Making

40. Explain in detail about arbitrage pricing theory

- Definition of APT
- Multifactor Model Concept
- Factors Affecting Asset Returns
- Comparison with CAPM
- Assumptions of APT
- Pricing Equation
- Arbitrage Mechanism

- Applications in Asset Pricing
- Empirical Validation
- Limitations

41. What is portfolio management? Discuss in detail the process of portfolio management.

Definition of Portfolio Management

Portfolio management is the art and science of making decisions about investment mix and policy, matching investments to objectives, asset allocation, and balancing risk against performance.

Process of Portfolio Management:

Setting Investment Objectives: Defining goals, time horizons, and risk tolerance.

Asset Allocation: Choosing the optimal distribution among asset classes to maximize return for a given risk.

Security Selection: Picking individual securities within asset classes based on analysis.

Portfolio Execution: Buying and selling securities according to strategy.

Performance Measurement: Tracking returns and risk through metrics like Sharpe ratio, alpha, beta.

Portfolio Revision and Rebalancing: Periodically adjusting holdings to maintain target allocation and respond to market changes or investor needs.

Risk Management: Identifying and mitigating various investment risks throughout the process.

Effective portfolio management enhances returns while controlling risk aligned with investor preferences.

42. Explain the concept of net asset value, total expense ratio, and pricing of units.

Net Asset Value (NAV):

The per-unit market value of a mutual fund's assets minus liabilities, calculated daily. It determines the price at which investors buy or redeem units.

Total Expense Ratio (TER):

The annual fee expressed as a percentage of fund assets including management fees, administrative expenses, and other operational costs.

Pricing of Units:

Units are priced at NAV for open-ended funds; investors buy/sell at NAV-based prices with potential loads (entry/exit fees). Closed-end funds trade on exchanges with prices fluctuating around NAV.

NAV reflects fund performance; TER directly impacts net returns; pricing mechanisms ensure transparency and fairness in transactions.

43. Discuss the importance of asset allocation decision.

- Risk Management:
Spreading investments mitigates risks from any single asset class.
- Return Optimization:
Balancing high and low-risk assets to enhance risk-adjusted returns.
- Alignment with Objectives:
Meets investor's risk tolerance and financial goals.
- Market Cycle Adaptation:
Asset allocation allows shifting between equities, bonds, cash based on market conditions.
- Diversification Benefits:
Reduces portfolio volatility and smoothens returns.
- Regulatory and Tax Considerations:
Influences investment decisions and post-tax performance.
- Proper asset allocation is fundamental to effective portfolio construction and long-term wealth creation.

44. Examine the parameters to define performance – risk and return.

- Return:
Measures the gain or loss on an investment over time, including income and capital appreciation.
- Risk:
The uncertainty or variability of returns from their expected value, often measured by volatility.
- Risk-Adjusted Return:

Metrics like Sharpe ratio that evaluate return relative to risk taken.

- **Benchmarking:**
Comparing performance against relevant indices or standards.
- **Consistency:**
Stability of returns over periods is considered alongside absolute return.
- **Drawdown:**
The measure of peak-to-trough losses reflects downside risk.
- **Time Horizon:**
Risk and return expectations vary by investment duration.
- **Liquidity:**
The ease with which an asset can be converted to cash without loss.
- **Performance evaluation balances maximizing return and minimizing risk.**

45. Pearl and Diamond are the two mutual funds. Pearl has a mean success of 0.15 and Diamond has 0.22. Diamond has double the beta of Pearl fund's 1.5. The standard deviations of Pearl and Diamond funds are 15% & 21.43%. The mean return of market index is 12% and its standard deviation is 7%. The risk-free rate is 8%. Compute the Jensen Index for each fund.

Calculation of Jensen's Alpha (Jensen Index) for Pearl and Diamond Mutual Funds

Given Data:

Parameter	Pearl	Diamond
Mean Return (R_i)	15% (0.15)	22% (0.22)
Beta (β)	1.5	3.0 (double of Pearl)
Standard Deviation (σ)	15% (0.15)	21.43% (0.2143)
Market Return (R_m)	12% (0.12)	12% (0.12)
Risk-Free Rate (R_f)	8% (0.08)	8% (0.08)

Jensen's Alpha Formula

$$\alpha = R_i - [R_f + \beta_i \times (R_m - R_f)]$$

Step 1: Calculate CAPM expected return for each fund

For Pearl

$$R_f + \beta_{\text{Pearl}} \times (R_m - R_f) = 0.08 + 1.5 \times (0.12 - 0.08) = 0.08 + 1.5 \times 0.04 = 0.08 + 0.06 = 0.14 (14\%)$$

For Diamond

$$R_f + \beta_{\text{Diamond}} \times (R_m - R_f) = 0.08 + 3.0 \times (0.12 - 0.08) = 0.08 + 3.0 \times 0.04 = 0.08 + 0.12 = 0.20 (20\%)$$

Step 2: Calculate Jensen's Alpha (α)

For Pearl

$$\alpha_{\text{Pearl}} = R_{\text{Pearl}} - \text{Expected Return}_{\text{Pearl}} = 0.15 - 0.14 = 0.01 (1\%)$$

For Diamond

$$\alpha_{\text{Diamond}} = R_{\text{Diamond}} - \text{Expected Return}_{\text{Diamond}} = 0.22 - 0.20 = 0.02 (2\%)$$

Step 3: Interpretation

- **Pearl's alpha is +1%**, indicating the fund exceeded its required return by 1% after adjusting for its systematic risk.
- **Diamond's alpha is +2%**, indicating a better risk-adjusted performance by outperforming its required return by 2%.

Though Diamond has higher risk (beta 3.0), it compensated investors with a relatively higher excess return, while Pearl, with less risk, also delivered positive alpha.

46. Discuss the capital asset pricing model and bring out its basic assumptions.

- Definition of CAPM
- Expected Return Formula
- Risk-Free Rate
- Market Risk Premium
- Beta (Systematic Risk)
- Assumptions of CAPM:
 - Investors are rational and risk-averse
 - Markets are perfect and frictionless
 - Investors have homogeneous expectations
 - Single period investment horizon
 - No taxes or transaction costs
 - Investors can borrow/lend at the risk-free rate
- Security Market Line (SML)
- Uses and Applications
- Limitations of CAPM

47. Examine the purpose of the performance measure portfolio?

- Evaluate Risk-Adjusted Returns
- Compare Against Benchmarks
- Assess Manager Skill
- Monitor Portfolio Objectives
- Guide Investment Decisions
- Identify Under/Outperformance
- Enhance Accountability
- Facilitate Portfolio Revision
- Aid in Diversification Assessment
- Support Long-Term Planning

48. Elaborate on the primary portfolio monitoring metrics for performance?

- Total Return
- Risk-Adjusted Return: Sharpe Ratio, Treynor Ratio
- Alpha (Jensen's Alpha)

- Beta
- Standard Deviation / Variance
- Tracking Error
- Drawdown
- Expense Ratio
- Turnover Ratio
- Benchmark Comparisons

49. Explain the metrics to Measure Portfolio Performance

1. Sharpe Ratio

Measures risk-adjusted return.

Formula: $(R_p - R_f) / \sigma_p$ where R_p = portfolio return, R_f = risk-free rate, σ_p = standard deviation.

Evaluates excess return per unit of total risk (volatility).

Higher ratio implies better risk-adjusted performance.

Useful for comparing portfolios with different risk levels.

2. Treynor Ratio

Measures return earned in excess of the risk-free rate per unit of systematic risk (beta).

Formula: $(R_p - R_f) / \beta_p$

Focuses on market risk, not total risk.

Useful for diversified portfolios where unsystematic risk is minimized.

3. Jensen's Alpha

Measures excess return above expected CAPM returns.

Formula: $\alpha = R_p - [R_f + \beta_p(R_m - R_f)]$.

Positive alpha indicates managerial skill and outperformance.

Helps assess if returns justify risk taken.

4. Information Ratio

Measures active return relative to tracking error.

Formula: $R_p - R_b / \text{Tracking Error}$,

where R_b = benchmark return.

Higher value indicates better performance compared to benchmark volatility.

Used for managers benchmarking against indexes.

5. Sortino Ratio

Similar to Sharpe but penalizes downside risk only.

Formula: $(R_p - R_f) / \text{Downside Deviation}$

Focuses on harmful volatility, more relevant for risk-averse investors.

6. Correlation to Benchmark

Measures how portfolio returns move relative to benchmark returns (range -1 to 1).

High correlation suggests portfolio mirrors benchmark; low indicates diversification.

Important for assessing tracking error.

7. Standard Deviation

Measures total volatility of portfolio returns.

Higher deviation indicates higher risk/uncertainty.

Used to quantify total risk (systematic + unsystematic).

8. Beta

Measures portfolio sensitivity to market movements (systematic risk).

Beta >1 implies more volatile than market; <1 less volatile.

Useful for understanding market risk exposure.

9. Maximum Drawdown

Largest peak-to-trough decline in portfolio value over a period.

Indicates worst potential loss.

Important for risk-averse investors and stress testing.

10. Annualized Return

Average yearly return over multiple periods, accounting for compounding.

Enables comparison across different investment horizons.

Used to evaluate long-term performance consistently.

50. Explain the principles of effective portfolio management and how do you measure security risk and market risk.

- Diversification
- Asset Allocation
- Risk-Return Trade-off
- Regular Monitoring and Rebalancing
- Liquidity Considerations
- Alignment with Investor Goals
- Security Risk Measurement:

- Standard Deviation
- Beta
- Value at Risk (VaR)
- Market Risk Measurement:
 - Beta
 - Systematic Risk Components
 - Risk Mitigation Techniques
 - Use of Performance Metrics

ABOUT THE AUTHORS



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