



STUDY NOTE - 3

CAPITAL MARKET ANALYSIS

This Study Note includes

- **Risk and return**
- **Stock Market Efficiency**
- **Investment Analysis**
- **Capital Asset Pricing Model vs Market Models**
- **Products of stock exchanges**
- **Derivatives markets**
- **Debt markets**
- **Commodity markets**
- **Portfolio management**
- **Mutual funds**

3.1 RISK AND RETURN

Risk Defined

Risk can be defined as the probability that the expected return from the security will not materialize. Every investment involves uncertainties that make future investment returns risk prone. Uncertainties could be due to the political, economic and industry factors.

Risk could be systematic in future depending upon the source of it. Systematic risk is for the market as a whole, while unsystematic risk is specific to an industry or the company individually. The first three risk factors discussed below are systematic in nature and the rest are unsystematic. Political risk could be whether it affects the market as a whole or just a particular industry.

Types of Investment Risk

i. Systematic vs Unsystematic Risk

Modern investment analysis categorizes the traditional sources of risk causing variability in returns into two general types: those that are pervasive in nature, such as market risk or interest rate risk, and those that are specific to a particular security issue, such as business or financial risk. Therefore, we must consider these two categories of total risk. The following discussion introduces these terms. Dividing total risk into its two



components, a general (market) component and a specific (issuer) component, we have systematic risk and nonsystematic risk, which are additive:

$$\begin{aligned}\text{Total risk} &= \text{General risk} + \text{Specific risk} \\ &= \text{Market risk} + \text{Issuer risk} \\ &= \textbf{Systematic risk} + \textbf{Nonsystematic risk}\end{aligned}$$

Systematic Risk : An investor can construct a diversified portfolio and eliminate part of the total risk, the diversifiable or non-market part. What is left is the non-diversifiable portion or the market risk. Variability in a security's total returns that is directly associated with overall movements in the general market or economy is called **systematic (market) risk**.

Virtually all securities have some systematic risk, whether bonds or stocks, because systematic risk directly encompasses interest rate, market, and inflation risks. The investor cannot escape this part of the risk because no matter how well he or she diversifies, the risk of the overall market cannot be avoided. If the stock market declines sharply, most stocks will be adversely affected; if it rises strongly, as in the last few months of 1982, most stocks will appreciate in value. These movements occur regardless of what any single investor does. Clearly, market risk is critical to all investors.

Non-systematic Risk: The variability in a security's total returns not related to overall market variability is called the **non-systematic (non-market or unsystematic) risk**. This risk is unique to a particular security and is associated with such factors as business and financial risk as well as liquidity risk. Although all securities tend to have some nonsystematic risk, it is generally connected with common stocks.

Remember the difference: Systematic (Market) Risk is attributable to broad macro factors affecting all securities. Nonsystematic (Non-Market) Risk is attributable to factors unique to a security. Different types systematic and unsystematic risk are explained as under:

1. Market Risk

The variability in a security's returns resulting from fluctuations in the aggregate market is known as market risk. All securities are exposed to market risk including recessions, wars, structural changes in the economy, tax law changes, even changes in consumer preferences. Market risk is sometimes used synonymously with systematic risk.

2. Interest Rate Risk

The variability in a security's return resulting from changes in the level of interest rates is referred to as interest rate risk. Such changes generally affect securities inversely; that is, other things being equal, security prices move inversely to interest rates. The reason for this movement is tied up with the valuation of securities. Interest rate risk affects bonds more directly than common stocks and is a major risk faced by all bondholders. As interest rates change, bond prices change in the opposite direction.

3. Purchasing Power Risk

A factor affecting all securities is purchasing power risk also known as inflation risk. This is the chance that the purchasing power of invested dollars will decline. With uncertain inflation, the real (inflation-adjusted) return involves risk even if the nominal return is



safe (e.g., a Treasury bond). This risk is related to interest rate risk, since interest rates generally rise as inflation increases, because lenders demand additional inflation premiums to compensate for the loss of purchasing power.

4. Regulation Risk

Some investments can be relatively attractive to other investments because of certain regulations or tax laws that give them an advantage of some kind. Municipal bonds, for example pay interest that is exempt from local, state and federal taxation. As a result of that special tax exemption, municipals can price bonds to yield a lower interest rate since the net after-tax yield may still make them attractive to investors. The risk of a regulatory change that could adversely affect the stature of an investment is a real danger. In 1987, tax law changes dramatically lessened the attractiveness of many existing limited partnerships that relied upon special tax considerations as part of their total return. Prices for many limited partnerships tumbled when investors were left with different securities, in effect, than what they originally bargained for. To make matters worse, there was not an extensive secondary market for these illiquid securities and many investors found themselves unable to sell those securities at anything but “firesale” prices if at all.

5. Business Risk

The risk of doing business in a particular industry or environment is called business risk. For example, as one of the largest steel producers, U.S. Steel faces unique problems. Similarly, General Motors faces unique problems as a result of such developments as the global oil situation and Japanese imports.

6. Reinvestment Risk

The YTM calculation assumes that the investor reinvests all coupons received from a bond at a rate equal to the computed YTM on that bond, thereby earning interest on interest over the life of the bond at the computed YTM rate. In effect, this calculation assumes that the reinvestment rate is the yield to maturity.

If the investor spends the coupons, or reinvests them at a rate different from the assumed reinvestment rate of 10 percent, the realized yield that will actually be earned at the termination of the investment in the bond will differ from the promised YTM. And, in fact, coupons almost always will be reinvested at rates higher or lower than the computed YTM, resulting in a realized yield that differs from the promised yield. This gives rise to reinvestment rate risk.

This interest-on-interest concept significantly affects the potential total dollar return. The exact impact is a function of coupon and time to maturity, with reinvestment becoming more important as either coupon or time to maturity, or both, rises. Specifically:

1. Holding everything else constant, the longer the maturity of a bond, the greater the reinvestment risk.
2. Holding everything else constant, the higher the coupon rate, the greater the dependence of the total dollar return from the bond on the reinvestment of the coupon payments.

Let's look at realized yields under different assumed reinvestment rates for a 10 percent



non-callable 20-year bond purchased at face value. If the reinvestment rate exactly equals the YTM of 10 percent, the investor would realize a 10 percent compound return when the bond is held to maturity, with \$4,040 of the total dollar return from the bond attributable to interest on interest. At a 12 percent reinvestment rate, the investor would realize a 11.14 percent compound return, with almost 75 percent of the total return coming from interest on interest (\$5,738 / \$7,738). With no reinvestment of coupons (spending them as received), the investor would achieve only a 5.57 percent return. In all cases, the bond is held to maturity.

Clearly, the reinvestment portion of the YTM concept is critical. In fact, for long-term bonds the interest-on-interest component of the total realized yield may account for more than three-fourths of the bond's total dollar return.

7. Bull- Bear Market Risk

This risk arises from the variability in the market returns resulting from alternating bull and bear market forces. When security index rises fairly consistently from a low point, called a trough, over a period of time, this upward trend is called a bull market. The bull market ends when the market index reaches a peak and starts a downward trend. The period during which the market declines to the next trough is called a bear market.

8. Management Risk

Management, all said and done, is made of people who are mortal, fallible and capable of making a mistake or a poor decision. Errors made the management can harm those who invested in their firms. Forecasting errors is difficult work and may not be the effort and, as a result, imparts a needlessly sceptical outlook.

An agent- principal principle relationship exists when the shareholder owners delegate the day to day decision making authority to managers who are hired employees rather than substantial owners. This theory suggests that owners will work harder to maximize the value of the company than employees will. Various researches in the field indicate that investors can reduce their losses to difficult-to-analyse management errors by buying shares in those corporations in which the executives have significant equity investments.

9. Default Risk

Is that portion of an investment's total risk that results from changes in the financial integrity of the investment? For example, when a company that issues securities moves either further away from bankruptcy or closer to it, these changes in the firm's financial integrity will be reflected in the market price of its securities. The variability of return that investors experience as a result of changes in the creditworthiness of a firm in which they invested is their default risk.

Almost all the losses suffered by investors as a result of default risk are not the result of actual defaults and / or bankruptcies. Investor losses from default risk usually result from security prices falling as the financial integrity of a corporation weakness-market prices of the troubled firm's securities will already have declined to near zero. However, this is not always the case – 'creative' accounting practices in firms like ENRON,



WorldCom, Arthur Anderson and Computer Associates may maintain quoted prices of stock even as the company's net worth gets completely eroded. Thus, the bankruptcy losses would be only a small part of the total losses resulting from the process of financial deterioration.

10. International Risk

International Risk can include both Country risk and Exchange Rate risk.

Exchange Rate Risk All investors who invest internationally in today's increasingly global investment arena face the prospect of uncertainty in the returns after they convert the foreign gains back to their own currency. Unlike the past when most U.S. investors ignored international investing alternatives, investors today must recognize and understand **exchange rate risk**, which can be defined as the variability in returns on securities caused by currency fluctuations. Exchange rate risk is sometimes called currency risk.

For example, a U.S. investor who buys a German stock denominated in marks must ultimately convert the returns from this stock back to dollars. If the exchange rate has moved against the investor, losses from these exchange rate movements can partially or totally negate the original return earned. Obviously, U.S. investors who invest only in U.S. stocks on U.S. markets do not face this risk, but in today's global environment where investors increasingly consider alternatives from other countries, this factor has become important. Currency risk affects international mutual funds, global mutual funds, closed-end single country funds, American Depositary Receipts, foreign stocks, and foreign bonds.

Country Risk Country risk, also referred to as political risk, is an important risk for investors today. With more investors investing internationally, both directly and indirectly, the political, and therefore economic, stability and viability of a country's economy need to be considered. The United States has the lowest country risk, and other countries can be judged on a relative basis using the United States as a benchmark. Examples of countries that needed careful monitoring in the 1990s because of country risk included the former Soviet Union and Yugoslavia, China, Hong Kong, and South Africa.

Liquidity Risk

Liquidity risk is the risk associated with the particular secondary market in which a security trades. An investment that can be bought or sold quickly and without significant price concession is considered liquid. The more uncertainty about the time element and the price concession, the greater the liquidity risk. A Treasury bill has little or no liquidity risk, whereas a small OTC stock may have substantial liquidity risk.

It is that portion of an asset's total variability of return which results from price discounts given or sales concessions paid in order to sell the asset without delay. Perfectly liquid assets are highly marketable and suffer no liquidation costs. Illiquid assets are not readily marketable and suffer no liquidation costs. Illiquid assets are not readily marketable – either price discounts must be given or sales commissions must be paid, or both the costs must be incurred by the seller, in order to find a new investor for an illiquid asset. The more illiquid the asset is, the larger the price discounts or the commissions that must be paid to dispose



of the assets.

Political Risk

It arises from the exploitation of a politically weak group for the benefit of a politically strong group, with the efforts of various groups to improve their relative positions increasing the variability of return from the affected assets. Regardless of whether the changes that cause political risk are sought by political or by economic interests, the resulting variability of return is called political risk if it is accomplished through legislative, judicial or administrative branches of the government.

Domestic political risk arises from changes in environmental regulations, zoning requirements, fees, licenses, and most frequently taxes. Taxes could be both direct and indirect. Some types of securities and certain categories of investors enjoy a privileged tax status.

International political risk takes the form of expropriation of non residents assets, foreign exchange controls that won't let foreign investors withdraw their funds, disadvantageous tax and tariff treatments, requirements that non residents investors give partial ownership to local residents, and un-reimbursed destruction of foreign owned assets by hostile residents of the foreign country.

Industry Risk

An industry may be viewed as group of companies that compete with each other to market a homogeneous product. Industry risk is that portion of an investment's total variability of return caused by events that affect the products and firms that make up an industry. For example, commodity prices going up or down will effect all the commodity producers, though not equally.

The stage of the industry's life cycle, international tariffs and/or quotas on the products produced by an industry, product/industry related taxes (e.g. cigarettes), industry wide labour union problems, environmental restrictions, raw material availability, and similar factors interact with and affect all the firms in an industry simultaneously. As a result of these common features, the prices of the securities issued by the competing firms tend to rise and fall together. These risk factors do not make up an exhaustive list but are only representative of the major classifications involved. All the uncertainties taken together make up the total risk, or the total variability of return.

Measurement of Risk

Volatility

Of all the ways to describe risk, the simplest and possibly most accurate is "the uncertainty of a future outcome". The anticipated return for some future period is known as the **expected return**. The actual return over some past period is known as the **realized return**. The simple fact that dominates investing is that the realized return on an asset with any risk attached to it may be different from what was expected. Volatility may be described as the range of movement (or price fluctuation) from the expected level of return. The more a stock, for example, goes up and down in price, the more volatile that stock is. Because wide price swings create more uncertainty of an eventual outcome, increased volatility can be equated with increased risk. Being able to measure and determine the past volatility of a security is important in that it provides some insight into the riskiness of that security as an investment.

Standard Deviation

Investors and analysts should be at least somewhat familiar with the study of probability



distributions. Since the return an investor will earn from investing is not known, it must be estimated. An investor may expect the TR (total return) on a particular security to be 10 percent for the coming year, but in truth this is only a “point estimate.”

Beta

Beta is a measure of the systematic risk of a security that cannot be avoided through diversification. Beta is a relative measure of risk-the risk of an individual stock relative to the market portfolio of all stocks. If the security's returns move more (less) than the market's returns as the latter changes, the security's returns have more (less) volatility (fluctuations in price) than those of the market. It is important to note that beta measures a security's volatility, or fluctuations in price, relative to a benchmark, the market portfolio of all stocks.

Securities with different slopes have different sensitivities to the returns of the market index. If the slope of this relationship for a particular security is a 45-degree angle, the beta is 1.0. This means that for every one percent change in the market's return, on average this security's returns change 1 percent. The market portfolio has a beta of 1.0. A security with a beta of 1.5, indicates that, on average, security returns are 1.5 times as volatile as market returns, both up and down. This would be considered an aggressive security because when the overall market return rises or falls 10 percent, this security, **on average**, would rise or fall 15 percent. Stocks having a beta of less than 1.0 would be considered more conservative investments than the overall market.

Beta is useful for comparing the relative systematic risk of different stocks and, in practice, is used by investors to judge a stock's riskiness. Stocks can be ranked by their betas. Because the variance of the market is a constant across all securities for a particular period, ranking stocks by beta is the same as ranking them by their absolute systematic risk. Stocks with high betas are said to be high-risk securities.

Risk and Expected Return

Risk and Expected return are the two key determinants of an investment decision. Risk, in simple terms, is associated with the variability of the rates of return from an investment ; how much do individual outcomes deviate from the expected value ? Statistically, risk is measured by any one of the measures of dispersion such as Co-efficient of range, variance, standard deviation etc.,

The Risk involved in investment depends on various factors such as :

- i) The length of the maturity period- longer maturity periods impart greater risk to investments.
- ii) The Credit-worthiness of the issuer of securities – the ability of the borrower to make periodical interest payments and pay back the principal amount will impart safety to the investment and this reduces risk.
- iii) The nature of the instrument or security also determines the risk. Generally, government securities and fixed deposits with banks tend to be the riskless or least risky ; Corporate debt instruments like the Debentures tend to be riskier than government bonds and ownership instruments like equity shares tend to be riskiest. The relative ranking of



instruments by risk is once again connected to the safety of the investment.

- iv) Equity shares are considered to be the most risky investment on account of the variability of the rates of returns and also because the residual risk of bankruptcy has to be borne by the equity holders.
- v) The liquidity of an investment also determines the risk involved in that investment. Liquidity of an asset refers to its quick saleability without a loss or with a minimum of loss.
- vi) In addition to the foretasted factors, there are also various others such as the economic, industry and firm specific factors which affect the risk an investment. A detailed analysis of these risk factors will be taken up in the next chapter.

Another major factor determining the investment decision is the rate of return expected by the investor. The rate of return expected by the investor consists of the yield and capital appreciation.

Determinants of Rate of return :

Therefore, three major determinants of the Rate of Return expected by the investor are :

- i) The time preference risk free real rate
- ii) The expected rate of inflation
- iii) The risk associated with the investment which is unique to the investment.

Hence,

Required return = Risk free real rate + Inflation premium + Risk Premium

It was stated earlier that the rate of return from an investment consists of the yield and capital appreciation if any. The difference between the sale price and the purchase price is the capital appreciation and the interest or dividend divided by the purchase price is the yield. Accordingly

$$\text{Rate of return (R)} = \frac{I_t + [P_t - P_{t-1}]}{P_{t-1}} = (\text{Eqn 1.1})$$

Where R_t = Rate of return per time period 't'

I_t = Income for the Period 't'

P_t = Price at the end of time period 't'

P_{t-1} = Initial price, i.e., price at the beginning of the period 't'.

In the above equation 't' can be a day or a week or a month or a year or years and accordingly daily, weekly, monthly or annual rates of return could be computed for most capital assets.

The above equation can be split in to two components. Viz.,



$$\text{Rate of return } (R_t) = \frac{I_t}{P_{t-1}} + \frac{P_t - P_{t-1}}{P_{t-1}} \quad (\text{Eqn 1.2})$$

Where $\frac{I_t}{P_{t-1}}$ is called the Current yield, and

$\frac{P_t - P_{t-1}}{P_{t-1}}$ is called the capital gain yield.

Or **ROR = Current yield + capital gain yield**

Illustration 1. The following information is given for a corporate bond. Price of the bond at the beginning of the year: Rs. 90, Price of the bond at the end of the year : Rs. 95.40, Interest received for the year : Rs. 13.50. Compute Rate of return

Solutions;

The rate of return can be computed as follows :

$$\frac{13.50 + (95.40 - 90)}{90} = 0.21 \text{ or } 21\% \text{ per annum}$$

The return of 21% consists of 15% current yield and 6% capital gain yield.

There is always a direct association between the rates of return and the asset prices. Finance theory stipulates that the price of any asset is equal to the sum of the discounted cash flows which the capital asset owner would receive. Accordingly the current price of any capital asset can be expected, symbolically, as

$$P_0 = \sum_{t=1}^n \frac{E(I)}{(1+r)^t} + \frac{P_n}{(1+r)^n}$$

Where $E(I)$ = expected income to be received in year 't'

P_0 = Current price of the capital asset

P_n = Price of the asset on redemption or on liquidation

R = The rate of return investors expect given the risk inherent in that capital asset.

Thus, 'r' is the rate of return, which the investors require in order to invest in a capital asset, that is used to discount the expected future cash flows from that capital asset.

Illustration 2

Mr. American has purchased 100 shares of Rs. 10 each of Kinetic Ltd. in 2005 at Rs. 78 per share. The company has declared a dividend @ 40% for the year 2006-07. The market price of share as at 1-4-2006 was Rs. 104 and on 31-3-2007 was Rs. 128. Calculate the annual return on the investment for the year 2006-07.

Dividend received for 2004-05 = Rs. 10 X 40/100 = Rs. 4

Solutions:

Calculation of annual rate of return on investment for the year 2006-07

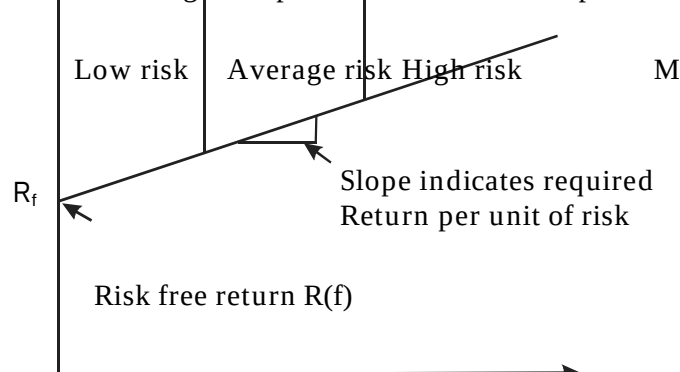
$$R = \frac{D_1 + (P_1 - P_0)}{P_0} = \frac{4 + (128 - 104)}{104} = 0.2692 \text{ or } 26.92\%$$

Risk-Return Relationship: The most fundamental tenet of Finance Literature is that there is a trade-off between risk and return. The risk-return relationship requires that the return on a security should be commensurate with its riskiness. If the capital markets are efficient operationally then all investment assets should provide a rate or return that is consistent with the risks associated with them. The Risk and return are directly variable. i.e., an investment with higher risk should produce higher return.

The risk/return trade-off could easily be called the ability-to-sleep-at-night test.” While some people can handle the equivalent of financial skydiving without batting an eye, others are terrified to climb the financial ladder without a secure harness. Deciding what amount of risk you can take while remaining comfortable with your investments is very important.

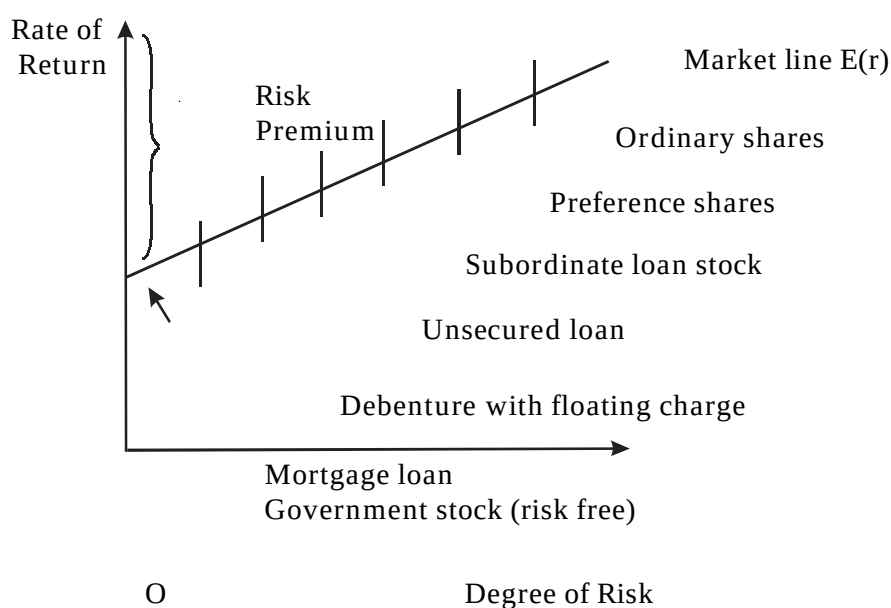
In the investing world, the dictionary definition of **risk** is the chance that an investment’s actual return will be different than expected. Technically, this is measured in statistics by standard deviation. Risk means you have the possibility of losing some, or even all, of our original investment.

Low levels of uncertainty (low risk) are associated with low potential returns. High levels of uncertainty (high risk) are associated with high potential returns. The risk/return tradeoff is the balance between the desire for the lowest possible risk and the highest possible return. This is demonstrated graphically in the chart below. A higher standard deviation means a higher risk and higher possible return. Figure represents the relationship between risk and return.



RISK AND RETURN RELATIONSHIP

The slope of the Market line indicates the return per unit of risk required by all investors. Highly risk-averse investors would have a steeper line, and vice versa. Yields on apparently similar stocks may differ. Differences in price, and therefore yield, reflect the market’s assessment of the issuing company’s standing and of the risk elements in the particular stocks. A high yield in relation to the market in general shows an above average risk element. This is shown in Figure



RISK RETURN RELATIONSHIP OF DIFFERENT STOCKS

Given the composite market line prevailing at a point of time, investors would select investments that are consistent with their risk preferences. Some will consider low risk investments, while others prefer high risk investments.

A common misconception is that higher risk equals greater return. The risk / return trade-off tells us that the higher risk gives us the possibility of higher returns. There are no guarantees. Just as risk means higher potential returns, it also means higher potential losses.

On the lower end of the scale, the risk-free rate of return is represented by the return on treasury Bill of Government Securities because their chance of default is next to nothing. If the risk-free rate is currently 8 to 10 %, this means, with virtually no risk, we can earn 8 to 10 % per year on our money.

The common question arises: who wants to earn 6% when index funds average 12% per year over the long run? The answer to this is that even the entire market (represented by the index fund) carries risk. The return on index funds is not 12% every year, but rather -5% one year, 25% the next year, and so on. An investor still faces substantially greater risk and volatility to get an overall return that is higher than a predictable government security. We call this additional return the risk premium, which in this case is 8% (12% - 8%).

Determining what risk level is most appropriate for you isn't an easy question to answer. Risk tolerance differs from person to person. Your decision will depend on your goals, income and personal situation, among other factors.

PORTFOLIO AND SECURITY RETURNS

A Portfolio is a collection of securities. Since it is rarely desirable to invest the entire funds of an individual or an institution in a single security, it is essential that every security be viewed in a



portfolio context. Thus, it seems logical that the expected return of a portfolio should depend on the expected return of each of the security contained in the portfolio. It also seems logical that the amounts invested in each security should be important. Indeed, this is the case. The example of a portfolio with three securities shown in Table A illustrates this point. The expected holding period value – relative for the portfolio is clearly:

$$\frac{\text{Rs. 23,100}}{\text{Rs. 20,000}} = 1.155$$

Giving an expected holding period return of 15.50 %.

(a) Security and Portfolio Values

Security	No.of Shares	Current Price Per Share	Current Value	Expected End-of-Period Share Value	Expected End-of-Period Share Value
1	2	3	4	5	6
XYZ	100	Rs. 15.00	1,500	Rs.18.00	Rs. 1,800
ABC	150	20.00	3,000	22.00	3,300
RST	200	40.00	8,000	45.00	9,000
KNF	250	25.00	6,250	30.00	7,500
DET	100	12.50	1,250	15.00	1,500
			Rs. 20,000		Rs. 23,100

(b) Security and Portfolio Value-Relatives

Security	Current Value	Proportion of current value of Properties	Current Price Per Share	Expected End-of-Period Value per share	Expected Holding-Period Value-Relative	Contribution to Portfolio Expected Holding-Period Value- Relative
(1)	(2)	3 = (2) Rs. 20,000	(4)	(5)	(6) = (5) / (4)	(7) = (3) X (6)
XUZ	Rs.1,500	.0750	Rs. 15,00	Rs.18.00	. 1,200	0.090000
ABC	3,000	.1500	20,00	22.00	1,100	0.165000
RST	8,000	.4000	40,00	45.00	1,125	0.450000
KNF	6,250	.3125	25,00	30.00	1,200	0.375000
DET	1,250	.0625	12,50	15.00	1,200	0.075000
	20,000	1.0000				1.155000

**(c) Security and Portfolio Holding-period Returns**

Security	Proportion of Current Value of Portfolio	Expected Holding Period Return (%)	Contribution to Portfolio Expected Holding Period Return (%)
1	2	3	4
XYZ	.0750	20.00	1.50
ABC	.1500	10.00	1.50
RST	.4000	12.50	5.00
KNF	.3125	20.00	6.25
DET	.0625	20.00	1.25
	<u>1.0000</u>		<u>15.50</u>

Since portfolio's expected return is a weighted average of the expected returns of its securities, the contribution of each security to the portfolio's expected returns depends on its expected returns and its proportionate share of the initial portfolio's market value. Nothing else is relevant. It follows that an investor who simply wants the greatest possible expected return should hold one security : the one which is considered to have the greatest expected return. Very few investors do this, and very few investment advisers would counsel such an extreme policy. Instead, investors should diversify, meaning that their portfolio should include more than one security. This is because diversification can reduce risk.

Illustration 6

The average market prices and dividend per share of Asian CERC Ltd. for the past 6 years are given below

Year	Average market price (Rs.)	Dividend per share(Rs.)
2007	68	3.0
2006	61	2.6
2005	50	2.0
2004	53	2.5
2003	45	2.0
2002	38	1.8

Solution:

Calculate the average rate of return of Asian CERC Ltd.'s shares for past 6 years.

Year	Average market price per share (Rs.)	Capital gain (%)	Dividend per share (Rs.)	Dividend yield (%)	Rate of return (%)
2002	38	-	1.8	4.74	-
2003	45	18.42	2.0	4.44	22.86
2004	53	17.78	2.5	4.72	22.50
2005	50	-5.66	2.0	4.00	-1.66
2006	61	22.00	2.6	4.26	26.26
2007	68	11.48	3.0	4.41	15.89

$$R = 1/5 (22.86 + 22.50 - 1.66 + 26.26 + 15.89) \\ = 1/5(85.85) = 17.17\%$$

RISK

All possible questions which the investor may ask, the most important one is concerned with the probability of actual yield being less than zero, that is, with the probability of loss. This is the essence of risk. A useful measure of risk should somehow take into account both the probability of various possible “bad” outcomes and their associated magnitudes. Instead of measuring the probability of a number of different possible outcomes, the measure of risk should somehow estimate the extent to which the actual outcome is likely to diverge from the expected.

Two measures are used for this purpose : the average (or mean) absolute deviation and the standard deviation

Illustration: 7

The rate of return of equity shares of Wipro Ltd., for past six years are given below:

Year	01	02	03	04	05	06
Rate of return (%)	12	18	-6	20	22	24

Calculate the average rate of return, standard deviation and variance.

Solutions

Calculation of Average rate of Return ($\bar{R}$)

$$\bar{R} = \frac{\sum R}{N} = \frac{12 + 18 - 6 + 20 + 22 + 24}{6} = 15\%$$

$$\sigma^2 = \frac{\sum (R - \bar{R})^2}{N}$$

Year	Rate of Return (%)	$(R - \bar{R})$	$(R - \bar{R})^2$
2001	12	-3	9
2002	18	3	9
2003	-6	-21	441
2004	20	5	25
2005	22	7	43
2006	24	9	81
		$\sum (R - \bar{R})^2 =$	614

$$\text{Variance } (\sigma)^2 = \frac{614}{6} = 102.33$$

$$\sigma = \sqrt{\sigma^2} = \sqrt{\text{Variance}}$$

$$\sqrt{102.33} = 10.12\%$$

Illustration 8

Mr.RKV invested in equity shares of Wipro Ltd., its anticipated returns and associated probabilities are given below:

Return %	-15	-10	5	10	15	20	30
Probability	0.05	0.10	0.15	0.25	0.30	0.10	0.05

You are required to calculate the expected rate of return and risk in terms of standard deviation.

Solutions:

Calculation of expected return and risk in terms of Standard Deviation

Return (R)	Probability (P)	(PXR)	$(R - \bar{R})$	$(R - \bar{R})^2$	$(R - \bar{R})^2 \times P$
-15	0.05	- 0.75	-5.5	30.25	1.5125
-10	0.10	-1.0	-0.5	0.25	0.0250
5	0.15	0.75	-4.5	20.25	3.0375
10	0.25	2.50	0.5	0.25	0.625
15	0.30	4.50	5.5	30.25	9.0750
20	0.10	2.00	10.5	110.25	11.0250
30	0.05	1.50	20.5	420.25	21.0125
	1.00	$\bar{R} = 9.5\%$		$\sum (R - \bar{R})^2 P =$	45.75



Expected Return $\bar{R} = \sum(PXR) = 9.5\%$

Standard Deviation $= \sqrt{\sum(R - \bar{R})^2 P} = \sqrt{45.75} = 6.764$

The risk in the above illustration, can be measured by taking the range of 45% (ie. 30%- (-) 15%) and standard deviation of 6.764. The investment carries greater risk in terms of high variation in return.

Illustration 9

The probabilities and associated returns of Modern Foods Ltd., are given below:

Return%	12	15	18	20	24	26	30
Probability	0.05	0.10	0.24	0.26	0.18	0.12	0.05

Calculate the standard deviation

Solution:

Return (R)	Probability (P)	(PxR)	$(R - \bar{R})$	$(R - \bar{R})^2 \times P$
12	0.05	0.60	- 8.56	3.664
15	0.10	1.50	- 5.56	3.091
18	0.24	4.32	- 2.56	1.573
20	0.26	5.20	- 0.56	0.082
24	0.18	4.32	3.44	2.130
26	0.12	3.12	5.44	3.551
30	0.05	1.50	9.44	4.456
	1.00	$\bar{R} = 20.56\%$	$\sum (R - \bar{R})^2 P = 18.547$	

Expected Return $\bar{R} = \sum(PXR) = 20.56\%$

Standard Deviation $= \sqrt{\sum(R - \bar{R})^2 P} = \sqrt{18.547} = 4.31\%$

The expected return is greater at 20.56%, the range of returns is 18% (i.e. 30% - 12%) and the standard Deviation is lower at 4.31%. The investment carries lesser risk in terms of low variation in return.


Illustration 10

Mr. Marin provides the following information from the same compute his expected return and standard deviation and variance

Events	1	2	3	4
Probability	.20	.40	.30	.10
Return (%)	-10	25	20	10

Solution:
Calculating the Mean Absolute Deviation

Event	Probability	Return %	PX Return	Deviation	Probability X Deviation	Probability X Absolute Deviation
(1)	(2)	(3)	(4)	(5)	(6)	(7)
a	.20	-10	-2.0	-25.0	-5.0	5.0
b	.40	25	10.0	10.0	4.0	4.0
c	.30	20	6.0	.0	1.5	1.5
d	.10	10	-1.0	-5.0	-0.5	0.5
Expected Return = 15.0					0	Average = 10.0 Absolute Deviation

Calculating the Standard Deviation

Event	Probability	Deviation	Deviation squared	Probability X Deviation
(1)	(2)	(3)	(4) = (3) 2	(5) = (2) X (4)
a	.20	-25.0	625.0	125.0
b	.40	10.0	100.0	40.0
c	.30	5.0	25.5	7.5
d	.10	-5.0	25.5	2.4
Variation = Weighted average squared deviation =				175.0
Standard Deviation = square root of variance =				13.2287

When an analyst predicts that a security will return 15% next year, he or she is presumably stating something comparable to an expected value. If asked to express the uncertainty about the outcome, he or she might reply that the odds are 2 out of 3 that the actual return will be within 10% of the estimate (i.e., 5% and 25%). The standard deviation is a formal measure of uncertainty, or risk, expressed in this manner, just as the expected value is a formal measure of a “best guess” estimate. Most analysts make such predictions directly, without explicitly assessing probabilities and making the requisite computations.

Illustration : 11

The possible returns and associated probabilities of Securities X and Y are given below:

Security X		Security Y	
Probability	Return %	Probability	Return %
0.05	6	0.10	5
0.15	10	0.20	8
0.40	15	0.30	12
0.25	18	0.25	15
0.10	20	0.10	18
0.05	24	0.05	20

Calculate the expected return and standard deviation of security X and Y

Solution:

Calculation expected Return and Standard Deviation of Security X

Probability (P)	Return % (R)	(PXR)	$(R - \bar{R})$	$(R - \bar{R})^2 P$
0.05	6	0.30	- 9.5	4.5125
0.15	10	1.50	-5.5	4.5375
0.40	15	6.00	-0.5	0.1000
0.25	18	4.50	2.5	1.5625
0.10	20	2.00	4.5	2.0250
0.05	24	1.20	8.5	3.6125
1.00		$\bar{R} = 15.5$	$\sum (R - \bar{R})^2 P = 16.35$	

Expected return of Security X $\bar{R} = 15.5\%$

Standard of Deviation of Security X

$$\sigma_y^2 = 16.35$$

$$\sigma_y = \sqrt{16.35} = 4.04\%$$



Calculation of Expected return and Standard Deviation of Security Y

Probability (P)	Return % (R)	(PXR)	$(R - \bar{R})$	$(R - \bar{R})^2 P$
0.10	5	0.50	-7.25	5.2563
0.20	8	1.60	-4.25	3.6125
0.30	12	3.60	-0.25	0.0188
0.25	15	3.75	2.75	1.8906
0.10	18	1.80	5.75	3.3063
0.05	20	1.00	7.75	3.0031
		12.25	$\sum (R - \bar{R})^2 P$	17.0876

Expected Return Security Y $\bar{R} = 12.25\%$

Standard of Deviation of Security Y

$$\sigma_y^2 = 17.0876$$

$$\sigma_y = \sqrt{17.0876} = 4.134\%$$

Analysis- Security A has higher expected return and lower level of risk as compared to Security Y.

Return and Risk of Portfolio

Return of Portfolio (Two Assets)

The expected return from a portfolio of two or more securities is equal to the weighted average of the expected returns from the individual securities.

$$\sum (R_p) = W_A (R_A) + W_B (R_B)$$

Where,

$$\sum (R_p) = \text{Expected return from a portfolio of two securities}$$

W_A = Proportion of funds invested in Security A

W_B = Proportion of funds invested in Security B

R_A = Expected return of Security A

R_B = Expected return of Security B

$$W_A + W_B = 1$$

**Illustration 13.**

A Ltd.'s share given a return of 20% and B Ltd's share gives 32% return. Mr. Gotha invested 25% in A Ltd shares and 75% of B Ltd. Shares. What would be the expected return of the portfolio.

Solution:

Portfolio Return

$$= 0.25(20) + 0.75 (32) = 29\%$$

Illustration 14.

Mr. RKV's portfolio consists of six securities The individual returns of each of the security in the portfolio is given below:

Security	Proportion of investment in the portfolio	Return
Wipro	10%	18%
Latham	25%	12%
SBI	8%	22%
ITC	30%	15%
RNL	12%	6%
DLF	15%	8%

Calculate the weighted average of return of the securities consisting the portfolio.

Solutions:

Security	Weight (W)	Return(%) (R)	(WxR)
Wipro	0.10	18	1.80
Latham	0.25	12	3.00
SBI	0.08	22	1.76
ITC	0.30	15	4.50
RNL	0.12	6	0.72
DLF	0.15	8	1.20
			12.98



\ Portfolio return is 12.98%

Risk of Portfolio (Two Assets)

The risk of a security is measured in terms of variance or standard deviation of its returns. The portfolio risk is not simply a measure of its weighted average risk. The securities consisting in a portfolio are associated with each other. The portfolio risk also considers the covariance between the returns of the investment, covariance of two securities is a measure of their co-movement, it expresses the degree to which the securities vary together. The standard deviation of two share portfolio is calculated by applying formula given below:

$$\sigma_p = \sqrt{W_A^2 \sigma_A^2 + W_B^2 \sigma_B^2 + 2 W_A W_B \rho_{AB} \sigma_A \sigma_B}$$

Where,

σ_p = Standard deviation of portfolio consisting securities A and B

$W_A W_B$ = Proportion of funds invested in Security A and Security B

$\sigma_A \sigma_B$ = Standard deviation of returns of Security A and Security B

ρ_{AB} = Correlation coefficient between returns of Security A and Security B

The correlation coefficient (ρ_{AB}) can be calculated as follows:

$$\rho_{AB} = \frac{Cov_{AB}}{\sigma_A \sigma_B}$$

The covariance of Security A and Security B ie., (Cov_{AB}) can be presented as follows :

$$Cov_{AB} = \sigma_A \sigma_B \rho_{AB}$$

The diversification of unsystematic risk, using two security portfolio, depends upon the correlation that exists between the returns of those two securities. The quantification of correlation is done through calculation of correlation coefficient of two securities (ρ_{AB}).

The value of correlation ranges between- 1 to 1, it can be interpreted as follows:

If $\rho_{AB} = 1$ No. unsystematic risk can be diversified

If $\rho_{AB} = -1$ All unsystematic risk can be diversified

If $\rho_{AB} = 0$ Correlation exists between the returns of Security A and Security B.

Illustration 16

The returns of Security Wipro and Security Infosys for the past six years are given below:

Year	Security Wipro Return %	Security Infosys Return %
2003	9	10
2004	5	-6
2005	3	12
2006	12	9
2007	16	15

Calculate the risk and return of portfolio consisting

Solution:

Calculation Mean Return and Standard Deviation of Security A

Year	Return % R	$(R - \bar{R})$	$(R - \bar{R})^2$
2003	8	0	0
2004	5	-4	16
2005	3	-6	36
2006	12	3	9
2007	16	7	49
	45		110

Mean Return $(\bar{R}) = 45/5 = 9\%$

Standard Deviation $(\sigma_A) = \sqrt{110} = 10.49\%$

Calculation Mean Return and Standard Deviation of Security B

Year	Return %	$(R - \bar{R})$	$(R - \bar{R})^2$
2001	10	2	4
2002	-6	14	196
2003	12	4	16
2004	9	1	1
2005	15	7	49
	40		266

Mean Return $(\bar{R}) = 40/5 = 8\%$

Standard Deviation $(\sigma_B) = \sqrt{266} = 16.31\%$

Analysis-Security A has a higher historic level return and lower risk as compared to Security B. Correlation Coefficient (ρ_{AB}).

$$= \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{N \sum X^2 - (\sum X)^2} \sqrt{N \sum Y^2 - (\sum Y)^2}}$$

A's return %		B's return %		
X	X ²	Y	Y ²	XY
9	81	10	100	90
5	25	-6	36	-30
3	9	12	144	36
12	144	9	81	108
16	256	15	225	240
$\sum X = 45$	$\sum X^2 = 515$	$\sum Y = 40$	$\sum Y^2 = 586$	$\sum XY = 444$

$$= \frac{(5 \times 5) - (45)^2 \sqrt{5 \times 586 - (40)^2}}{\sqrt{(5 \times 515) - (45)^2} \sqrt{5 \times 586 - (40)^2}}$$

$$= \frac{2,220 - 1800}{\sqrt{2575 - 2025} \sqrt{2930 - 1600}} = \frac{420}{\sqrt{550} \sqrt{1330}}$$

$$= \frac{420}{23.452 \times 36.469} = \frac{420}{855.271} = 0.491$$

Verification:

Calculation of Covariance of Returns of Securities A and B

Year	Returns %		$(R_A - \bar{R}_A)$	$(R_B - \bar{R}_B)$	$(R_A - \bar{R}_A) \times (R_B - \bar{R}_B)$
	A	B			
2001	9	10	0	2	0
2002	5	-6	-4	-14	56
2003	3	12	-6	4	-24
2004	12	9	3	1	3
2005	16	15	7	7	49
					$Cov_{AB} = 84$

$$\rho_{AB} = \frac{\text{Cov}_{AB}}{\sigma_A \sigma_B} = \frac{84}{10.49 \times 16.31} = 0.491$$

$$\text{Cov}_{AB} = \sigma_A \sigma_B \rho_{AB} = 10.49 \times 16.31 \times 0.491 = 84$$

Return of portfolio (R_p)

$$= (0.80 \times 9) + (0.20 \times 8) = 7.2 + 1.6 = 8.8\%$$

Risk of portfolio (σ_p)

$$\begin{aligned} \sigma_p^2 &= (0.80^2 \times 10.49^2) + (0.20^2 \times 16.31^2) + (2 \times 0.80 \times 0.20 \times 10.49 \times 16.31 \times 0.491) \\ &= (0.64 \times 110.04) + (0.04 \times 266.02) + 26.88 \\ &= 70.43 + 10.64 + 26.88 = 107.95 \end{aligned}$$

$$\sigma_p = \sqrt{107.95} = 10.39\%$$

Risk and Return of Portfolio (Three Assets)

Formula for calculating risk of portfolio consisting three securities

$$\sigma_p^2 = W_x^2 \sigma_x^2 + W_y^2 \sigma_y^2 + W_z^2 \sigma_z^2 + 2W_x W_y \rho_{xy} \sigma_x \sigma_y + 2W_y W_z \rho_{yz} \sigma_y \sigma_z + 2W_x W_z \rho_{xz} \sigma_x \sigma_z$$

Where,

- W_1, W_2, W_3 = Proportion of amount invested in securities X Y and Z
- $\sigma_x, \sigma_y, \sigma_z$ = Standard deviations of securities X, Y and Z
- ρ_{xy} = Correlation coefficient between securities X and Y
- ρ_{yz} = Correlation coefficient between securities Y and Z
- ρ_{xz} = Correlation coefficient between securities X and Z

Illustration 17

A portfolio consists of three securities P, Q and R with the following parameters:

	P	Security Q	R	Correlation coefficient
Expected return (%)	35	22	20	
Standard deviation (%)	20	26	24	
Correlation coefficient:				
PQ				-0.5
QR				+0.4
PR				+0.6



If the securities are equally weighted, how much is the risk and return of the portfolio of these three securities?

Solutions:

Expected Portfolio Return

$$= (25 \times 1/3) + (22 \times 1/3) + (20 \times 1/3) = 22.33\%$$

$$\sigma_p^2 = (30)^2 (1/3)^2 + (26)^2 + (24)^2 (1/3)^2 + 2(1/3)(-0.5)(30)(26) \\ + 2(1/3)(1/3)(0.4)(26)(24) + 2(1/3)(1/3)(0.6)(30)(24)$$

$$\sigma_p^2 = 100 + 75.11 + 64 - 86.67 + 55.47 + 96 = 303.91$$

$$\sigma_p = \sqrt{303.91} = 17.43\%$$

Optimal Portfolio (Two assets)

The investor can minimise his risk on the portfolio. Risk avoidance and risk minimisation are the important objectives of portfolio management. A portfolio contains different securities, by combining their weighted returns we can obtain the expected return of the portfolio. A risk averse investor always prefer to minimise the portfolio risk by selecting the optimal portfolio. The minimum risk portfolio with two assets can be ascertained as follows:

$$W_A = \frac{\sigma_B^2 - \text{Cov}_{AB}}{\sigma_A^2 + \sigma_B^2 - \text{Cov}_{AB}}$$

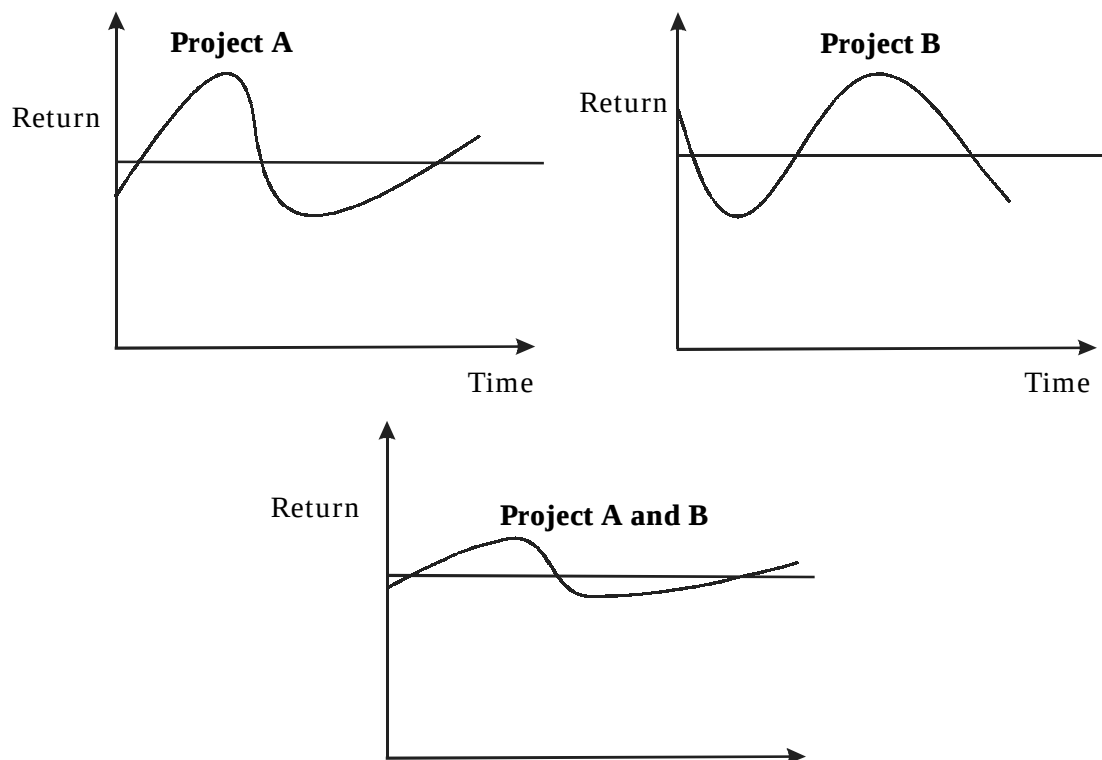
In continuation to illustration 10 we can calculate the proportion to be invested (W_A) in Security A.

$$= \frac{16.31^2 - 84}{(10.49^2 + 16.31^2) - (2 \times 84)} = \frac{182.02}{208.06} = 0.875$$

Therefore, 87.5% of funds should be invested in Security A and 12.5% should be invested in Security B, which represents the optimal portfolio.

Portfolio Diversification and Risk

In an efficient capital market the important principle to consider is that, **investors should not hold all their eggs in one basket**; investor should hold a well diversified portfolio. In order to understand portfolio diversification one must understand correlation. Correlation is a statistical measure that indicates the relationship, if any, between series of numbers representing anything from cash flows to test data. If the two series move together, they are positively correlated; if the series move they are positively correlated; if the series move in opposite directions, they are negatively correlated. The existence of perfectly correlated especially negatively correlated- projects is quite rare. In order to diversify project risk and thereby reduce the firm's overall risk, the projects that are best combined or added to the existing portfolio of projects are those that have a negative (or low positive) correlation with existing projects. By combining negatively correlated projects, the overall variability of returns or risk can be reduced. Figure 32.2 illustrates the result of diversifying to reduce risk.



REDUCTION OF RISK THROUGH DIVERSIFICATION

It shows that a portfolio is containing the negatively correlated projects A and B, both having the same expected return, E, also has the return E, but less risk (ie. Less variability of return) than either of the projects taken separately. This type of risk is sometimes described as diversifiable or alpha risk. The creation of a portfolio by combining two perfectly correlated projects cannot reduce the portfolio's overall risk below the risk of the least risky project, while the creation of a portfolio combining two projects that are perfectly negatively correlated can reduce the portfolio's total risk to a level below that of either of the component projects, which in certain situations may be zero.

Benefits of Diversification:

The gains in risk reduction from portfolio diversification depend inversely upon the extent to which the returns on securities in a portfolio are positively correlated. Ideally the securities should display negative correlation. This implies that if a pair of securities has a negative correlation of returns, then in circumstances where one of the securities is performing badly the other is likely to be doing well and vice versa in reverse circumstances. Therefore the average 'return on holding the two securities is likely to be much 'safer' than investing in one of them alone.



Utility Function and Risk Taking

Common investors will have three possible attitudes to undertake risky course of action (i) an aversion to risk (ii) a desire to take risk, and (iii) an indifference to risk. The following example will clarify the risk attitude of the individual investors.

Illustration 18

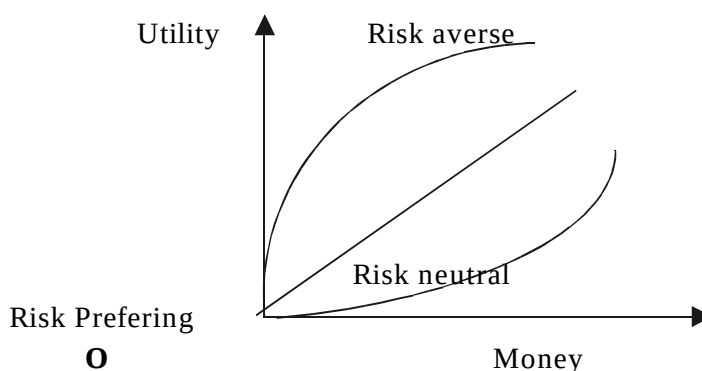
The possible outcomes of two alternatives A and B, depending on the state of economy are as follows:

State of economy	Possible outcome (Rs)	
	A	B
Normal	100	100
Boom	110	200

If we assume that the three states of the economy are equally likely, then expected value for each alternative is Rs. 100.

- A risk seeker is one who, given a choice between more or less risky alternatives with identical expected values, prefers the riskier alternative ie., alternative B.
- A risk averted would select the less risky alternative Le., alternative A.
- The person who is indifferent to risk (risk neutral) would be indifferent to both alternative A and B, because they have same expected values.

The empirical evidence shows that majority of investors are risk-averse. Some generalisations concerning the general shape of utility functions are possible. People usually regard money as a desirable commodity, and the utility of a large sum is usually greater than the utility of a smaller sum. Generally a utility function has a positive slope over an appropriate range of money values, and the slope probably does not vary in response to small changes in the stock of money. For small changes in the amount of money going to an individual the slope is constant and the utility function is linear. If the utility functions linear, decision maker maximises expected utility by maximising expected monetary value. However, for large variations in the amount of money this likely to be the case. For large losses and large gains the utility function after approaches upper and lower limits. The slope of the curve will usually increase sharply as the amount of loss increases, because the disutility of a large loss is proportionately more than the disutility of a small loss, but the curve will flatten as the loss becomes very large. For a risk averse decision maker, the expected utility of a function is less than the utility of the expected monetary value. It is also possible for the decision maker to be risk preferring, at least over some range of the utility function. In its case the expected utility of a function is more than the utility function. In this case the expected utility of a function is more than the utility of the expected monetary value (EMV).



UTILITY FUNCTION AND RISK TAKING

Illustration 18:

National Corporation is planning to invest in a security that has several possible rates of return. Given the following probability distribution returns, what is the expected rate return on investment? Also compute the standard deviation of the returns. What do the resulting numbers represent?

Solutions;

Probability (P)	Return (R)	Expected Return [E(R)]	Weighted Return
(1)	(2)	(3) = (1) X (2)	[E(R)-R] ² P
0.10	-10%	-1%	52.9%
0.20	5%	1%	12.8%
0.30	10%	3%	2.7%
0.40	25%	10%	57.6%
		<u>E = 13%</u>	$\sigma^2 = 126.0$
			$\sigma = 11.22\%$

From our studies in statistics, we know that if the distribution of returns were normal, then National could expect a return of 13% with a 67% possibility that this return would vary up or down by 11.22% between 1.78%(13% - 11.22%) and 24.22%(13% + 11.22%). However, it is apparent from the probabilities that the distribution is not normal.

**Illustration 19**

Assume that the current rate on a one – year security is 7 percent. You believe that the yield on a one-year security will be 9 percent one year from now and 10 percent 2 years from now. According to the expectations hypothesis, what should the yield be on a three-year security?

Solution:

Find the geometric mean by averaging the continuously compounded rates.

$$[\ln(1.07) + \ln(1.09) + \ln(1.10)] / 3$$

$$(0.06766 + 0.08618 + 0.09531) / 3$$

$$= 0.24915 / 3$$

$$= 0.08305$$

Then converting to nominal rate :

$$\text{Exp. } (0.08305) - 1 = 0.0866$$

Your expectation imply that the current rate on a three-year security shall be 8.66 percent.

Illustration 20

RKV is evaluating a security. One year Treasury bills are currently paying 9.1 percent. Calculate the below investment's expected return and its standard deviation. Should RKV invest in this security?

Probability	.15%	.30%	.40%	.15%
Return	15	7	10	5

Solution:

Probability (P)	Return (R)	Expected Return	Weighted Return
(1)	(2)	(3) = (1) X (2)	
0.15	15%	2.25%	5.22
0.30	7	2.10	1.32
0.40	10	4.00	0.32
0.15	5	0.75	2.52
		<u>E(R) = 9.1%</u>	$\sigma^2 = 9.39\%$
			$\sigma = 3.06\%$

RKV should not invest in this security. The level of risk is excessive for a return which is equal to the rate offered on treasury bills.



Illustration 21

T.S. Shekhar has a portfolio of five securities. The expected rate and amount of investment in each security is as follows :

Security	A	B	C	D	E
Expected Return	.14	.08	.15	.09	.12
Amount invested	Rs.20,000	Rs.10,000	Rs.30,000	Rs.25,000	Rs.15,000

Compute the expected return on Shekhar's portfolio.

Solutions:

The expected return on Shekhar's portfolio is :

$$\begin{aligned}E(R_p) &= (20,000 / 1,00,000).14 + (10,000 / 1,00,000).08 + (30,000 / 1,00,000).15 \\&\quad + (25,000 / 1,00,000).09 + (15,000 / 1,00,000).12 \\&= .028 + .008 + .045 + .0225 + .018 = .1215 \\&= 12.15\%\end{aligned}$$

Illustration 22

T.S. Kumar holds a two-stock portfolio. Stock ABC has a standard deviation of returns of .6 and stock XYZ has a standard deviation of .4. The correlation coefficient of the two stocks returns is 0.25. Kumar holds equal amounts of each stock. Compute the portfolio standard deviation for the two-stock portfolio.

Solutions:

$$\begin{aligned}\sigma_p &= \sqrt{.5^2 \times .6^2 + 2 \times .5 \times .5 \times .6 \times .4 \times .25 + .5^2 \times .4^2} \\&= \sqrt{.09 + .03 + .04} \\&= \sqrt{.16} = .4\end{aligned}$$

Illustration 23:

Ravi Shankar has prepared the following information regarding two investments under consideration. Which investment should be accepted ?

Security ABC		Security XYZ	
Probability	Return	Probability	Return
0.30	27%	0.21	15%
0.50	18%	0.30	6%
0.30	-2%	0.40	10%
-	-	0.10	4%

**Solutions:**

Investment in security ABC				Investment in security XYZ			
Probability	Return	Expected Return	Weighted Deviation	Probability	Return	Expected Return	Weighted Deviation
				0.20%	15%	3.0%	6.728%
0.30	27%	8.1%	31.8%	0.30	6	1.8	3.072
0.40	18	9.0	0.8	0.30	10	4.0	0.256
0.30	-2	-0.4	69.9	0.20	4	0.4	
		E(R) =	σ =			E(R) =	σ = 12.76%
		16.7%	102.5%			9.2%	
			σ =				σ = 3.57%
			10.12%				

Illustration 24

Ammy, a Korean-based auto manufacturer, is evaluating two overseas locations for proposed expansion of production facilities, one site in Neerland and another on Forexland. The likely future return from investment in cash site depends to great extent on future economic conditions. These scenarios are postulated, and the internal rate of return from cash investment is computed under each scenario. The results with their estimated probabilities are shown below:

Probability	Internal Rate of Return (%)	
	Neerland	Forexland
0.3	20	10
0.3	10	30
0.4	15	20

Required :

Calculate the expected value of the IRR and the standard deviation of the return of investments in each location. What would be the expected return and the standard deviation of the following split investment strategies :

- committing 50% of the available funds to the site in Neerland and 50% to Forexland.
- committing 75% of the available funds to the site in Neerland and 25% to Forexland site? (Assume zero correlation between the returns from the two sites)

Solution:**Neerland :**

Expected Value of IRR

$$\begin{aligned}
 &= (0.3 \times 20\%) + (0.3 \times 10\%) + (0.4 \times 15\%) \\
 &= 6\% + 3\% + 6\% \\
 &= 15\%
 \end{aligned}$$

Outcome (1)	Deviation (2)	Sq'd Dev (3)	P (4)	Sq'd Dev. Xp (5) = (3) (4)
20	+5	25	.3	7.5
10	-5	25	.3	7.5
15	0	0	.4	0
Variance = Total				15
=				
$\sigma = 3.87$				

Forexland :

Expected Value of IRR

$$\begin{aligned}
 &= (0.3 \times 10) + (0.3 \times 30\%) + (0.4 \times 20\%) \\
 &= 3\% + 9\% + 8\% \\
 &= 20\%
 \end{aligned}$$

Outcome (1)	Deviation (2)	Sq'd Dev (3)	P (4)	Sq'd Dev. Xp (5) = (3) (4)
10	-10	100	.3	30
30	+10	100	.3	30
20	0	0	.4	0
Variance =				60
Total =				
$\sigma = 7.75$				

(b) (i) For a 50/50 split investment

$$\begin{aligned}
 &\text{EV for IRR} \\
 &= (0.5 \times 15) + (0.5 \times 20\%) \\
 &= 17.5\% \\
 &\sigma = 4.33
 \end{aligned}$$

(ii) For a 75/25 split investment

$$\begin{aligned}
 &= (10.75 \times 15\%) + (0.25 \times 20\%) \\
 &= 16.25\% \\
 &\sigma = 3.49, \text{ i.e., Lower Risk, Lower Return}
 \end{aligned}$$

Illustration 25

You have invested Rs. 50,000, 30 percent of which is invested in Company A, which has a expected rate of return of 15 percent, and 70 percent of which is invested in Company B, with an expected return of 12 percent. What is the return on you portfolio ? What is the expected percentage rate of return?

**Solutions:**

- (a) The rate of return is the percentage of the amount invested in as stock multiplied by its expected rate of return. Thus, of the Rs. 50,000 invested.

Company A – 30 percent of total with 15 percent rate of return :

$$30 \times \text{Rs. } 50,000 \times .15 = \text{Rs. } 2,250$$

Company B – 70 percent with a 12 percent rate of return :

$$70 \times \text{Rs. } 50,000 \times .12 = \text{Rs. } 4,200$$

The total return is Rs. 6450 (i.e., Rs. 2250 + Rs.4,200)

- (b) The expected percentage rate of return is the total return divided by the amount invested:

$$r = \frac{\text{Total Return}}{\text{Total amount invested}}$$

$$r = \frac{\text{Rs. } 6450}{\text{Rs. } 50,000} = 12.90\%$$

Illustration 26

Suppose you invest in four securities. Company ABC has an expected return of 20 percent, Company BCD has an expected return of 10 percent, Company CDE has an expected return of 12 percent, and Company DEF has an expected return of 9 percent. You have invested Rs. 40,000. What is the expected rate of return on your portfolio?

Solution:

The expected rate of return is the weighted average of expected rates in the portfolio :

$$E(R_p) = \sum_{i=1}^n W_i E(R_i)$$

The portfolio weights are first determined by the formula

$$W_A = \frac{\text{Rs. Invested in ABC}}{\text{Total equity investment}}$$

Since you have invested equally in four securities and total investment is Rs.40,000, the portfolio weight are equal ($W_{ABC} = W_{BCD} = W_{CDE} = W_{DEF}$) and are determined:

$$W_A = \frac{\text{Rs. } 10,000}{\text{Rs. } 40,000} = .25$$

Hence, the expected return on the individual securities and the expected rate of return on the portfolio is :

$$R_p = (W_{ABC} \times r_{ABC}) + (W_{BCD} \times r_{BCD}) + (W_{CDE} \times r_{CDE}) + (W_{DEF} \times r_{DEF})$$

$$= (.25 \times .20) + (.25 \times .10) + (.25 \times .12) + (.25 \times .09)$$

$$= .1275 = 12.75\%$$



Illustration 27

Assume the investor in Problem 41 wants to determine how risky his portfolio and wants you to compute the portfolio variance. If the expected correlations and variance of the stocks are as follows, what is the variance of the portfolio?

Correlations	ABC	BCD	CDE	DEF
BCD	.50	-	-	-
CDE	.60	.30	-	-
DEF	-.30	-.20	-.10	-
Variances:	.04	.16	.02	.10

Solution:

To Compute the variance, you need to make a covariance matrix. Using the square roots of the variances and correlations given, the covariance are calculated:

$$\text{Cov}(r_{ABC}, R_{BCD}) = .500 \times .200 \times .400 = .040$$

$$\text{Cov}(r_{ABC}, R_{CDE}) = .600 \times .200 \times .141 = .070$$

$$\text{Cov}(r_{ABC}, R_{DEF}) = -.300 \times .200 \times .316 = -.019$$

$$\text{Cov}(r_{BCD}, R_{CDE}) = .300 \times .400 \times .141 = .017$$

$$\text{Cov}(r_{BCD}, R_{DEF}) = .200 \times .400 \times .316 = -.025$$

$$\text{Cov}(r_{CDE}, R_{DEF}) = .100 \times .141 \times .316 = .004$$

With the given variance and the portfolio weights, the covariance matrix is as follows:

Securities	Weights	ABC	BCD	CDE	DEF
		.25	.25	.25	.25
ABC	.25	.04	.040	.017	-.019
BCD	.25	.040	.16	.017	-.025
CDE	.25	.017	.017	.02	-.004
DEF	.25	-.019	-.025	-.004	.10

Multiplying each covariance by the weight at the top of the column and at the left of the row and summing, we get;

$$.25 \times .25 \times .04 = .0025$$

$$.25 \times .25 \times .040 = .0025$$

$$.25 \times .25 \times .017 = .0011$$

$$.25 \times .25 \times -.019 = .0012$$

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$$\begin{aligned}
 .25 \times .25 \times .040 &= .0025 \\
 .25 \times .25 \times .160 &= .0100 \\
 .25 \times .25 \times .017 &= .0011 \\
 .25 \times .25 \times -.025 &= .0016 \\
 .25 \times .25 \times .017 &= .0011 \\
 .25 \times .25 \times .017 &= .0011 \\
 .25 \times .25 \times .020 &= .0013 \\
 .25 \times .25 \times -.004 &= .0003 \\
 .25 \times .25 \times -.019 &= .0012 \\
 .25 \times .25 \times -.025 &= -.0016 \\
 .25 \times .25 \times .004 &= -.0003 \\
 .25 \times .25 \times .100 &= .0063
 \end{aligned}$$

Total portfolio variance = .0223

Illustration 27

Suppose you have Rs. 10,000 to invest and would like to sell Rs. 5000 in stock XYZ short to invest in ABC. Assuming no correlation between the two securities, compute the expected return and the standard deviation of the portfolio from the following characteristics:

Security	ABC	XYZ
E(R)	.12	.02
σ (R)	.08	.10

Solutions:

Expected Return :

$$\begin{aligned}
 E(R)_p &= W_{ABC} E(R_{ABC}) + W_{XYZ} E(R_{XYZ}) \\
 &= \frac{15,000}{10,000} .2 - \frac{5,000}{10,000} .2 \\
 &= .18 - .01 = .17
 \end{aligned}$$

Standard deviation:

$$\begin{aligned}
 [W_{ABC}^2 \sigma^2(R_{ABC}) + W_{XYZ}^2 \sigma^2(R_{XYZ})]^{1/2} &= \sigma_p \\
 &= [(1.5)^2 \times (.08)^2 + (-.5)^2 \times (.10)^2]^{1/2} \\
 &= .130
 \end{aligned}$$



Illustration 28

Suppose we have two portfolio known to be on the minimum variance set for a population of three securities. A, B, and C. There are no restrictions on short sales. The weights for each of the two portfolios are as follows:

	W_A	W_B	W_C
Portfolio X	.24	.52	.24
Portfolio Y	-.36	.72	.64

- (a) What would the stock weights be for a portfolio constructed by investing Rs. 2,000 in portfolio X and Rs. 1000 in portfolio Y?
- (b) Suppose you invest Rs. 1500 of the Rs. 3000 in Security X. How will you allocate the remaining Rs. 1500 between Securities X and Y to ensure that your portfolio is on the minimum variance set ?

Solutions:

- (a) Given a Rs. 2000 investment in portfolio X and Rs. 1000 investment in portfolio Y, the investment committed to each security would be :

	A	B	C	Total
Portfolio X	Rs.480	Rs.1040	Rs.480	Rs.2000
Portfolio Y	-360	720	640	1000
Confirmed Portfolio	Rs.120	Rs.1760	Rs.1120	Rs. 3000

Since we are investing a total of Rs.3000 in the combined portfolio, the investment position in three securities are consistent with the following portfolio weights

	W_A	W_B	W_C
Combined portfolio	.04	.59	.37

- (b) Since the equation for the critical line takes the following form:

$$W_B = a + bW_A$$

Substituting in the values for W_A and W_B from portfolio X and Y, we get

$$.52 = a + .24b$$

$$.72 = a + -.36b$$

By solving these equations simultaneously, we can obtain the slope and the intercept of the critical line

$$W_B = .6 - 1/3 W_A$$

Using this equation, we can find W for any given W_A if we invest half of the funds in security A ($W_A = .5$), then

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$$W_B = .6 - 1/3 (.5) = .43$$

Since $W_A + W_B + W_C = 1$, we know $W_C = 1 - W_A - W_B$

Substituting in our value for W and W , we find

$$W_C = .6 - .5 - .43 = .07$$

Illustration 29

A stock that pays no dividends is currently selling at Rs.100. The possible prices for which the stock might sell at the end of one year, with associated probabilities, are

End-of-year Price	Probability
Rs.90	0.1
100	0.2
110	0.4
120	0.2
130	0.1

- Calculate the expected rate of return by year-end.
- Calculate the standard deviations of the expected rate of return.

Solutions:

(a) Probable	0.1	0.2	0.4	0.2	0.1
Return	-10	0	10	20	30
E(R)	=	$0.1(-10) + 0.2(0) + 0.4(10) + 0.2(20) + 0.1(30)$			
	=	$-1.0 + 0 + 4.0 + 4 + 3.0$			
	=	10.0%			
(b) σ	=	$[0.1(-10-10)^2 + 0.2(0-10)^2 + 0.4(10-10)^2 + 0.2(20-10)^2 + 0.1(30-10)^2]^{.5}$			
	=	10.95%			

Key Words

Risk

Systematic risk

Unsystematic risk

Return

Risk return trade off

Standard deviation

Variance

Beta

Alpha

Portfolio

Optimum portfolio



Summary

Corporations are managed by people and therefore open to problems associated with their faulty judgments. Moreover, the corporations operate in a highly dynamic and competitive environment, and many operate both nationally and internationally. As a result, the judgment factor still dominates investment decisions. Risk can be defined as the probability that the expected return from the security will not materialize. Every investment involves uncertainties that make future investment returns risk prone. Uncertainties could be due to the political, economic and industry factors. Risk could be systematic in future depending upon the source of it. Systematic risk is for the market as a whole, while unsystematic risk is specific to an industry or the company individually. The first three risk factors discussed below are systematic in nature and the rest are unsystematic. Political risk could be whether it affects the market as whole or just a particular industry.

Beta is a measure of the systematic risk of a security that cannot be avoided through diversification. Beta is a relative measure of risk-the risk of an individual stock relative to the market portfolio of all stocks. If the security's returns move more (less) than the market's returns as the latter changes, the security's returns have more (less) volatility (fluctuations in price) than those of the market. It is important to note that beta measures a security's volatility, or fluctuations in price, relative to a benchmark, the market portfolio of all stocks.

The risk/return trade-off could easily be called the ability-to-sleep-at-night test." While some people can handle the equivalent of financial skydiving without batting an eye, others are terrified to climb the financial ladder without a secure harness. Deciding what amount of risk you can take while remaining comfortable with your investments is very important.

The investor can minimise his risk on the portfolio. Risk avoidance and risk minimisation are the important objectives of portfolio management. A portfolio contains different securities, by combining their weighted returns we can obtain the expected return of the portfolio.

Objective questions:

1. The external factors that affects the industry as a whole is termed as ____ (Controllable risk ; Systematic risk ; Unsystematic risk)
2. Interest rates _____ as Inflation increase. (decrease ; increase ; not affected)
3. _____ is the measure of systematic risk of a security (alpha ; Beta ; Arithmetic Mean)Un
4. The risk attributable to factors unique to a security is _____(Market risk ; Systematic risk ; Unsystematic risk)
5. Increase in Interest Rates will _____ the security price (Decrease ; Increase ; Neutralise)
6. If a bond is purchased at Rs.110 and sold at Rs. 117. The interest received for the year was Rs. 10. The rate of return will be _____ (15% p.a. ; 7% p.a. ; 10% p.a.)

Short questions:

1. Define Return
2. Define risk
3. What do you mean by Security Return?
4. Define risk and what are the different types of risk influence on investment?



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5. Explain Systematic Risk and Unsystematic Risk
6. Define beta? How does it influence in investment decision making process?
7. Define Alpha
8. How do you measure Historical return and risk?
9. Explain the concept 'Expected return and Risk'
10. Write different steps in calculating Expected return and Risk.
11. What do you mean by portfolio diversification?

Problems to Solve :

1. The returns of Jaz Ltd., stock during the past five years were as follows:

Problems to Solve :

1. The returns of Jaz Ltd., stock during the past five years were as follows:

Year	Return
1	0.07
2	0.03
3	0.06
4	- 0.09
5	0.10

Compute the following:

- (a) Cumulative wealth Index
- (b) Arithmetic Mean
- (c) Geometric Mean
- (d) Variance
- (e) Standard Deviation

2. A stock XY earns the following returns over a five year period:

$r_1 = 0.20$, $r_2 = - 0.10$, $r_3 = 0.18$, $r_4 = 0.16$, $r_5 = 0.12$. What is the standard deviation and variance of returns of stock XY?

3. The probability distribution and the rate of return on Penta Stock and Jade Stock is given below:

Penta Stock		Jade Stock	
Probability	Rate of Return	Probability	Rate of Return
0.50	12%	0.30	15%
0.30	25%	0.40	-09%
0.20	- 6%	0.30	20%

Calculate the standard deviation of return and suggest the best alternative for investment.

4. The return of two assets under four possible states of return are given below

State of Nature	Probability	Return on asset 1	Return on asset 2
1	0.10	5%	0%
2	0.30	10%	9 %
3	0.50	15%	18%
4	0.10	25%	26%

- What is the Standard deviation of the return on asset 1? And Asset2?
 - What is the covariance between the returns on assets 1 and 2?
 - What is the coefficient between the returns on assets 1 and 2?
5. A portfolio consists of 3 securities, 1, 2 and 3. The proportions of these securities are: $w_1=0.3$, $w_2=0.5$ and $w_3=0.2$. The standard deviations of returns on these securities (in percentage terms) are $\sigma_1=6$, $\sigma_2=9$ and $\sigma_3=10$. The correlation coefficients among security returns are $\rho_{12}=0.4$, $\rho_{13}=0.6$, $\rho_{23}=0.7$. What is the standard deviation of portfolio return?
6. The following information is available.

	Stock A	Stock B
Expected Return	18%	12%
Standard Deviation	5%	8%
Coefficient of correlation	0.60	

- What is the covariance between stocks A and B?
 - What is the expected return and risk of a portfolio in which A and B have weights of 0.6 and 0.4.
7. The return of two assets under four possible states of return are given below:

State of Nature	Probability	Return on asset 1	Return on asset 2
1	0.30	-5%	10%
2	0.20	14%	13%
3	0.10	17%	15%
4	0.40	23%	19%



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- What is the Standard deviation of the return on asset 1 and on asset 2?
 - What is the covariance between the returns on assets 1 and 2?
 - What is the coefficient of correlation between the returns on assets 1 and 2?
8. The stock of Zeal Ltd. performs well relative to other stocks during recessionary periods. The stock of Tybe Co Ltd., on the other hand, does well during growth periods. But the stocks are currently selling for Rs.50 per share. The rupee return (dividend plus price change) of these stocks for the next year would be as follows:

	Economic Condition			
	High Growth	Low Growth	Stagnation	Recession
Probability	0.3	0.3	0.2	0.2
Return on Alpha stock	55	50	60	70
Return on Beta stock	75	65	5	40

Calculate the expected return and standard deviation of:

- Rs.1000 in the equity stock of Alpha;
 - Rs.1000 in the equity stock of Beta;
 - Rs.500 in the equity stock of Alpha and Rs.500 in the equity stock of Beta;
 - Rs.700 in the equity stock of Alpha and Rs.300 in the equity of Beta. Which of the above four options would you choose? Why?
9. Consider two stocks, A and B

	Expected Return (%)	Standard Deviation (%)
Stock A	14%	22%
Stock B	20%	35%

The returns on the stocks are perfectly negatively correlated.

What is the expected return of a portfolio comprising of stocks A and B when the portfolio is constructed to drive the standard deviation of portfolio return to zero?

10. From the following information, you are required to compute:
- Covariance between stocks XML and QRS
 - Expected Return and Risk of a portfolio in which stocks XML and QRS are equally weighted.

	Stock XML	Stock QRS
Expected Return	16%	22%
Standard Deviation	25%	40%
Coefficient of Correlation	0.40	



11. Which of the following portfolio constitute the efficient set:

Portfolio	Expected Return(%)	Standard Deviation (%)
1	12	20
2	14	24
3	8	16
4	9	15
5	10	20
6	15	30
7	14	22
8	16	30

[Answers – Objective questions: 1. b ; 2. b ; 3 b ; 4. c ; 5. a ; 6. a]

3.2 STOCK MARKET EFFICIENCY

Market efficiency / Capital market efficiency : The degree to which the present asset price accurately reflects current information in the market place. Efficient capital market : A market in which new information is very quickly reflected accurately in share prices.

Efficient Market Hypothesis : States that all relevant information is fully and immediately reflected in a security's market price, thereby assuming that an investor will obtain an equilibrium rate of return. In other words, an investor should not expect to earn an abnormal return (above the market return) through either technical analysis or fundamental analysis.

Efficient Market Hypothesis

The efficient market hypothesis (EMH) implies that if new information is revealed about a firm it will be incorporated into the share price rapidly and rationally, with respect to the direction of the share price movement and the size of that movement.

In an efficient market no trader will be presented with an opportunity for making a return on a share (or other security) that is greater than a fair return for the riskiness associated with that share (or any other security). The absence of abnormal profit possibilities arises because current and past information is immediately reflected in current prices. It is only new information, which causes prices to change.

Note: Stock market efficiency does not mean that investors have perfect powers of prediction; all it means is that the current level is an unbiased estimate of its true economic value based on the information revealed.

In the major stock markets of the world prices are set by forces of supply and demand. There are hundreds of analysts and thousands of traders, each receiving new information on a company through electronic and paper media. The moment an unexpected, positive piece of information leaks out investors will act and prices will rise rapidly to a level that gives no opportunity to make further profit.

Types of Efficiency

Efficiency is an ambiguous word and therefore we have to establish some clarity. There are three types of efficiency;



Operational efficiency – refers to the cost to buyers and sellers of transactions in securities on the exchange. It is desirable that the market carries out its operations at as low a cost as possible. This may be promoted by creating as much competition between market makers and brokers as possible so that they earn only normal profits and not excessively high profits. It may also be enhanced by competition between exchanges for secondary-market transactions.

Allocation efficiency – society has a scarcity of resources (that is, they are not infinite) and it is important that we find mechanisms, which allocate those resources to where they can be most productive. Those industrial and commercial firms with the greatest potential to use investment funds effectively need a method to channel funds their way. Stock markets help in the process of allocating society's resources between competing real investments. For example, an efficient market provides vast funds for fast-growth sectors such as electronics, pharmaceuticals and biotechnology industries (through new issues, rights issues, etc.) but allocates only small amounts for slow-growth industries.

Pricing efficiency – in a pricing efficient market the investor can expect to earn merely a risk-adjusted return from an investment as prices move instantaneously and in an unbiased manner to any news. It is pricing efficiency that is the focus of this section and the term efficient market hypothesis applies to this form of efficiency only.

The Value of an Efficient Market

It is important that stock / share markets are efficient for at least three reasons: To encourage share buying – accurate pricing is required if individuals are going to be encouraged to invest in private enterprise. If shares are incorrectly priced many savers will refuse to invest because of a fear that when they come to sell the price may be perverse and may not represent the fundamental attractions of the firm. This will seriously reduce the availability of funds to companies and inhibit growth. Investors need to know they are paying a fair price and that they will be able to sell at a fair price – that the market is a “fair game”.

To give correct signals to company managers – Since the maximization of shareholder wealth can be represented by the share price in an efficient market, sound financial decision-making relies on the correct pricing of the company's shares. In implementing a shareholder wealth-enhancing decision the manager will need to be assured that the implication of the decision is accurately oneself to shareholders and to management through a rise in the share price. It is important that managers receive feedback on their decisions from the share market so that they are encouraged to pursue shareholder wealth strategies.

To help allocate resources – allocation efficiency requires both operating efficiency and pricing efficiency. If a poorly run company in a declining industry has highly valued shares because the stock market is not pricing correctly then this firm will be able to issue new shares, and thus attract more of society's savings for use within its business. This would be wrong for society as the funds would be better used elsewhere.

The Levels of Market Efficiency

Economists have defined different levels of efficiency according to the type of information, which is reflected in prices. Three levels of market efficiency can be identified.

Weak-form efficiency – share prices fully reflect all information contained in past price



movements. It is pointless basing trading rules on share price history, as the future cannot be predicted in this way.

A Weak-form Efficiency Test Example: Technical analysts employ a vast range of trading rules. Some recommend buying shares that have performed well relative to the rest of the market, maintaining that their performance will continue in that vein. Others advise a purchase when a share rises in price at the same time as an increase in trading volume occurs. Overwhelmingly the evidence and weight of academic opinion is that the weak form of the EMH is to be accepted. The history of share prices cannot be used to predict the future in any abnormally profitable way.

Semi-strong form efficiency – share prices fully reflect all the relevant publicly available information. This includes not only past price movements but also earnings and dividend announcements, rights issues, technological breakthroughs, resignations of directors, and so on. The semi-strong form of efficiency implies that there is no advantage in analyzing publicly available information after it has been released, because the market has already absorbed it into the price.

A Semi-strong form Efficiency Test Example: The semi-strong form tests focus on the question of whether it is worthwhile expensively acquiring and analyzing publicly available information. If semi-strong efficiency is true it undermines the work of millions of fundamental (professional or amateur) analysts whose trading rules cannot be applied to produce abnormal returns because all publicly available information is already reflected in the share price.

Fundamental analysts try to estimate shares' true value based on future returns. These are then compared with the market price to establish an over- or under valuation. To estimate the intrinsic value of a share the fundamentalists gather as much relevant information as possible. This may include:

- macroeconomic growth projections,
- industry conditions,
- company accounts and announcements,
- details of company's personnel, tax rates,
- technological and social change and so on.

The range of potentially important information is vast, but it is all directed at one objective: forecasting future profits and dividends. Some evidence for and against the semi-strong form of market efficiency has been discovered in the following:

- **Information announcements:** This concerns the issue of whether trading in shares immediately following announcements of new information (for example announcements on dividends or profit figures) could produce abnormal returns. The evidence supports the EMH, and excess returns are nil. It has been discovered that most of the information in annual reports, profit or dividend announcements are reflected in share prices before the announcement is made.
- **Stock splits:** Stock splits imply that existing shareholders receive more shares in proportion to their existing holding. Because no new money is raised for the firm, and the



fundamentals of the business such as cash flows are unchanged, prices should not react purely to a stock split. However, the split itself is an insignificant part of the information given to the market around the time of the announcement, as splits tend to occur when firms are doing well. The split is often taken as a final confirming signal that the firm anticipates continued growth and that dividends will rise. Fama et. Al. (1969) showed that share prices rise by an abnormal amount relative to the market prior to the split.

- **Manipulation of earnings:** Published accounts are an important source of information about companies. An efficient market will incorporate this information into share prices. But, as is well known, there is a great deal of leeway when it comes to drawing up accounts. One way of altering accounts is to openly and honestly reflect the changing underlying economies of the business by changing, say, the depreciation policy.

If this is taken a stage further we have creative accounting, which obeys the letter of the law and accounting body rules but involves the manipulation of the accounts to show the most favourable profit figures and balance sheet. Finally, there is outright fraud and lies. The conclusion of efficiency in this case seems reasonable because investors are aware of the nature of the accounting change, but doubts have been raised about market efficiency if there is wholesale creative accounting.

Strong-form of efficiency – all relevant information, including that which is privately held, is reflected in the share price. Here the focus is on insider trading, in which a few privileged individuals (for example directors) are able to trade in shares, as they know more than the normal investor in the market. In a strong-form efficient market even insiders are unable to make abnormal profits (note that the market is acknowledged as being inefficient at this level of definition).

A Strong form Efficiency - Test Example: It is well known that it is possible to trade shares on the basis of information not in the public domain and thereby make abnormal profits. In this respect stock markets are not strong form efficient. Trading on inside knowledge is thought to be a “bad thing”. It makes those outside of the charmed circle feel cheated. A breakdown of the fair game perception will leave some investors feeling that the inside traders are making profits at their expense. If they start to believe that the market is less than a fair game they will be more reluctant to invest and society will suffer. To avoid the loss of confidence in the market most stock exchanges attempt to curb insider dealing and it is a criminal offence for most exchanges (if not all). Insider trading is considered to be, besides dealing for oneself, either counseling or procuring another individual to deal in the securities or communicating knowledge to any other person, while being aware that he or she (or someone else) will deal in those securities.

Misconceptions about the Efficient Market Hypothesis

There are three classic misconceptions:

1. Any share portfolio will perform as well as or better than a special trading rule designed to outperform the market. A monkey choosing a portfolio of shares from the “Financial Times” for a buy and hold strategy is nearly, but not quite, what the EMH advocates suggest as a strategy likely to be as rewarding as special inefficiency-hunting approaches. The monkey does not have the financial expertise needed to construct broadly based portfolios, which fully diversify away unsystematic risk. A selection of shares in just one



or two industrial sectors may expose the investor to excessive risk. So it is wrong to conclude from EMH evidence that it does not matter what the investor does, and that any portfolio is acceptable. The EMH says that after first eliminating unsystematic risk by holding broadly based portfolios and then adjusting for the residual systematic risk, investors will not achieve abnormal returns.

2. There should be fewer price fluctuations.

If shares are efficiently priced why is it that they move every day even when there is no announcement concerning a particular company? This is what we would expect in an efficient market. Prices move because new information is coming to the market every hour, which may have some influence on the performance of a specific company. For example, the governor of the Central bank may hint at an interest rate rise, or the latest industrial output figures may be released, etc.

3. Only a minority of investors is actively trading, most are passive therefore efficiency cannot be achieved. This too is wrong. It only needs a few trades by informed investors using all the publicly available information to position (through their buying and selling actions) a share at its semi-strong-form efficient price.

Implications of the Efficient Market Hypothesis

The efficient market hypothesis has a number of implications for both the investors and the companies.

For Investors For the vast majority of people public information cannot be used to earn abnormal returns (that is, returns above the normal level for that systematic risk class). The implication is that fundamental analysis is a waste of money and that so long as efficiency is maintained the average investor should simply select a suitably diversified-portfolio, thereby avoiding costs of analysis and transaction. Investors need to press for a greater volume of timely information. Semi-strong efficiency depends on the quality and quantity of publicly available information, and so companies should be encouraged by investor pressure, accounting bodies, government rulings and stock market regulation to provide as much as is compatible with the necessity for some secrecy to prevent competitors gaining useful knowledge. The perception of a fair game market could be improved by more constraints and deterrents placed on insider dealers.

For Companies The EMH also has a number of implications for companies:

Focus on substance, not on short-term appearance: Some managers behave as though they believe they can fool shareholders. For example creative accounting is used to show a more impressive performance than is justified. Most of the time these tricks are transparent to investors, who are able to interpret the real position, and security prices do not rise artificially.

There are some circumstances when the drive for short-term boosts to reported earnings could be positively harmful to shareholders. For example, one firm might tend to overvalue its stock to boost short-term profitability, another might not write off bad debts. These actions will result in additional, or at least earlier, taxation payments, which will be harmful to shareholder wealth. Managers, aware that the analysts often pay a great deal of attention to accounting rate of return, may, when facing a choice between a project with a higher NPV but a poor short-term ARR, or one with a lower NPV but higher short-term ARR, choose the latter.

The timing of security issues does not have to be fine-tuned: Consider a team of managers contemplating a share issue who feel that their shares are currently under-priced because the



market is low. They opt to delay the sale, hoping that the market will rise to a more “normal level”. This defies the logic of the EMH – if the market is efficient the shares are already correctly priced and it is just as likely that the next move in prices will be down as up. The past price movements have nothing to say about future movements.

The situation is somewhat different if the managers have private information that they know is not yet priced into the shares. In this case if the directors have good news then they would be wise to wait until after an announcement and subsequent adjustment to the share price before selling the new shares. Bad news announcements are more tricky – to sell the shares to new investors while withholding bad news will benefit existing shareholders, but will result in loss for the new shareholders.

Short Questions:

1. What do you understand by EMH?
2. State the Implications of Strong, Weak and Semi-Strong Forms of EMH.
3. On what grounds the EMH was refuted?
4. Give reasons in favour and against of the EMH in the current scenario.
5. Is EMH suitable to the Indian Stock Market?

3.3 INVESTMENT ANALYSIS**Introduction:**

Unlike natural science and like medicine, law and economics, investing lies somewhere between an art and a science. Certain aspects of investing lend themselves to a scientific approach. The creation of computer skills has accelerated the use of scientific methods.

However, corporations are managed by people and therefore open to problems associated with their faulty judgments. Moreover, the corporations operate in a highly dynamic and competitive environment, and many operate both nationally and internationally. As a result, the judgment factor still dominates investment decisions.

Whether investing will ever be classified as a science is doubtful, but research, training and experience have developed investing into a discipline. Discipline means a structured, consistent and orderly process without rigidity in either concept or methods.

Stock Market Analysis helps the investors in formulating their investing/trading techniques prior to the opening of the market. This helps them to confirm their conviction on trades. Stock Market Analysis deals with the performance of the stocks in particular and the indexes in general.

Stock Market Index typically gives the overall performance of the market or of a specific sector. It is based on the statistical compilations of the prices of the representative set of stocks and reflects a composite value of its component stocks.

There are many factors affecting the collective mood of the stock market. Stock Market is a dynamic one which changes with every information due to change in perception of the investors. Stock Market believes in supremacy of the market and considers that demand-supply mechanism leads to efficient price discovery. It also considers that the market discounts/considers everything and presumes every investor to be rational who invest by considering all the informations (economic and political (domestic and international) scenario, weather condition,



company specific news, international relations, monetary and fiscal policies, international Stock Market behavior and many more) available to him.

Stock Market Analysis is a prerequisite for any investor for extracting profit out of the stock market. But most of the investors don't have the time and knowledge for analyzing the market. So, they take the help of professional Stock Market Analysts who guide them through the financial jungle to a profitable outcome.

Stock Market Analysis is basically of two types :-

- Fundamental Analysis
- Technical Analysis

Fundamental Analysis tries to measure the intrinsic value of a **stock** by going through its financial, economic, quantitative and qualitative factors. It also considers the **macroeconomic factors** (both domestic and international) that could have an effect on the value of the **stock**. Some of the company or industry specific factors are Sales figure of the company (Quarterly, Yearly, etc.), Earnings of the Company, Assets and Liabilities of the Company, Management Efficiency of the Company, Company's competitive position among its industry rivals. **Fundamental Analysts** rely on the balance sheets of the company for arriving at its book value. This helps them to compare the actual value of the **stock** in the secondary market with that of the book value in order to evaluate whether the **stock** is overvalued or not. When the Market Value of a **stock** exceeds its Face or Intrinsic value then it signifies that the expectations of the investors are higher than the real value of the company. Hence, a correction in its price is evident. **Fundamental Analysis** studies the **fundamental** strength of the company which is effective in gauging the long run scenario of the **stock** price rather than the short run fluctuations. **Fundamental Analyst** look at the following aspects for judging the **fundamental** strength of the company :-

- **Balance Sheet**
- **Return on Assets**
- **Net Income**
- **Revenue**
- **Cash Flow**

Balance Sheet

Financial position of a company is reflected through its Balance Sheet where the detailed numerical of the assets and liabilities are recorded. It is always desirable for a company to have Assets > Liabilities which reflects its sound financial condition.

Return on Assets

It measures the profitability of a company.

$$\text{Return on Assets} = (\text{Net Income of the company for the last 1 year}) / (\text{Total Assets of the Company})$$

This shows the company's strength from the long term perspective and is a good indicator for the long term investors.

Net Income

$$\text{Net Income} = (\text{Total Revenue of the Company}) - (\text{Total Cost to the Company})$$



Revenue of a company comprises of income from the sales of its products, and other incomes. Cost of a company comprises operation costs, servicing of depreciation, interest payments, etc. Another business and economic jargon for Net Income is Bottom Line.

Revenue

Revenue of a company comprises its income from sales of its products, and other associated incomes. It indicates the demand scenario of the company's products which are also an indicator of its growth.

Cash Flow

Cash Flow of a Company (for a particular period of time) = (Cash Receipts of a Company) – (Cash Payments of the Company)

Liquidity Position of the company can be gauged by analyzing this tool.

Hence, **Fundamental Analysis** is a part of the **Stock Market Analysis** which uses the **fundamental** aspects of the companies and the economy for predicting the future direction of the **stock** in particular and the economy in general.

Fundamental Analysis:

As has been mentioned earlier, in the fundamental approach, attempt is made to analyze various fundamental or basic factors that affect the risk-return of the securities. Effort, here, is to identify those securities which perceive to be mispriced in the stock market. The assumption in this case is that the 'market price' of security and the price as justified by its fundamental factors called 'intrinsic value' are different and the capital market provides an opportunity for a discerning investor to detect such discrepancy. The moment such a description is identified, the decision to invest or disinvest is taken. The decision rule under this approach is like this,

If the price of a security at the market place is higher than the one, which is justified by the security fundamentals, sell that security. This is because, it is expected that the market will sooner or later realize mistake and price the security properly, a deal to sell this security should be based on its fundamentals, it should be both before the market correct its mistake by increasing the price of security in question. The price prevailing in market is called "market price" (MP) and the one justified by its fundamentals is called 'intrinsic value' (IV) session rules/ Recommendations.

- (1) If $IV > MP$, buy the security
- (2) If $IV < MP$, sell the security
- (3) If $IV > MP$, No Action.

The fundamental factors mentioned above may relate to the economy or industry or company or all some of this. Thus, economy fundamentals, industry fundamentals and company fundamentals are considered while prizing the securities for taking investment decision. In fact the economy-industry-company framework forms integral part of this approach. This framework can be properly utilized by making suitable adjustments in a regular context. A world of caution? Please remember, the use of an analytical framework does not guarantee a act decision. However, it does guarantee an informed and considered investment decision which would hopefully letter as it based on relevant and crucial information

Fundamental Analysis and Efficient Market

Before elaborating in detail on the economy-industry-company framework, it is pertinent to mention that .. are expressed about the utility of this approach in the contest of efficient stock market set up. Briefly the market efficiency relates to the speed with which stock market incorporates the information about the economy industry and company in the share prices rather instantaneously. The above given view about share market efficiency implies that no one would be able to make abnormal to given such a set up. Some research studies in the literature also support the above view. Practitioners, However, do not agree to such conclusions of empirical nature.

Fundamental Analysis and Chemistry of Earnings :

The logic for fundamental analysis becomes crystal clear once we understand the chemistry of earnings' and macro and macro factors which influence the future of earnings.

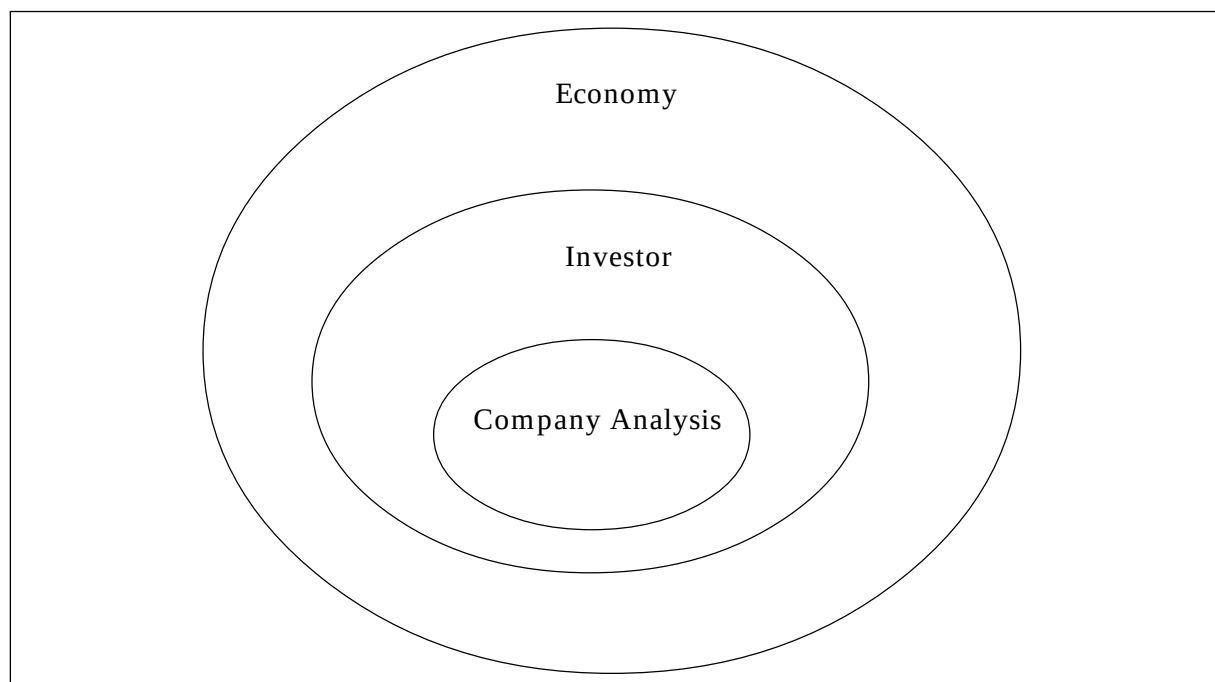
Factors Affecting Distributable Earnings				
Board Source/form Of Earnings	Company Specific Factors		Industry Factors	Macro- Economic
Sales	Competitive strength	M	Industry Demand/ Supply	National income, sp.. savings, Monetary.. Credit, Export-Import...
		A		Policies, Population Price level.
Less Costs Of sales	Operating Efficiency	N	Industry wage Levels: Industrial Infrastructure Import-Export Policy	National Wage policy Price levels, Economic Infrastructure, Raw ... Production.
Earnings Before Interest Depreciation & Taxes (EBIDT)		A		
Less Interest	Capital Structure/financial Leverage Policy	G		
		A	Industry Cost of capital	Interest Rates in the Economy, Capital Conditions
Less Deprecation	Operational leverage Policy	E	Industry practices	Capital Goods Import
Less Tax	Tax Planning and Management	M	Industry Lobby	Fiscal Policy
Net Earnings After Tax (NEAT)		E		
Less (Preference Dividend)	Capital Structure Policy		Industry Practices	Interest Rate Structure, Capital... Conditions
Distributable Earnings		N		
Less Equity Dividend	Dividend Policy		Industry Practices	Fiscal Policy,, Credit Capital Market cond...
Retained Earnings		T		

Economy – Industry – Company Analysis: a Framework

The analysis of economy, industry and company fundamentals as mentioned above is the main ingredient of fundamental approach. The analyst should take into account all the three constituents which form different but special steps in making investment decision. These can be looked at as different stages in the investment decision making. Operationally to base the investment decision on various fundamentals, all the three stages must be taken into account. In this Unit, we will concentrate on economy and industry analyses while in the next Unit focus on company level analysis.

Economy Analysis

In actual practice, you must have noticed that investment decision of individuals and the institute made in the economic set up of a particular country. It becomes essential, therefore, to understand the state economy of that country at macro level. The analysis of the state of the economy at macro level incorporates the economy has performed in the past, how it is performing in the present and how it is expected to perform in the future. Also relevant in this context is to know how various sectors of the economy are going to grow in the

**Macro Economic Analysis**

The analysis of the following factors indicates the trends in macro economic changes that effect the risk and return on investments.

- Money supply
- Industrial production
- Capacity utilisation



- Unemployment
- Inflation
- Growth in GDP
- Institutional lending
- Stock prices
- Monsoons
- Productivity of factors of production
- Fiscal deficit
- Credit/Deposit ratio
- Stock of food grains and essential commodities
- Industrial wages
- Foreign trade and balance of payments position
- Status of Political and economic stability
- Industrial wages
- Technological Innovations
- Infrastructural facilities
- Economic and industrial policies of the government
- Debt recovery and loans outstanding
- Interest rates
- Cost of living index
- Foreign investments
- Trends in capital market
- Stage of the business cycle
- Foreign exchange reserves

Technical Analysis

Technical Analysis assumes that the historical price movements of **stocks** give indications about its future performances. It uses charts and other statistical tools to identify the pattern of the **stock** and index movements and accordingly predict its future activities. **Technical Analysts** are not concerned about the intrinsic or fair value of the company but are only interested in the historical price movements along with the volumes. They consider that the price movements are repetitive in nature because the psychological setup of the investors are seen to follow a certain pattern. **Technical Analysts** analyze a wide array of variables such as **Long term and Short term market trend, Volume of trade, Oscillators, Moving Averages, Cross-overs, Candlesticks, Relative Strength Index**, etc. which could throw an idea about the future movement of the **Stock**.

Thus, **Stock Market Analysis** helps both the investors and the traders in taking calculative risk for churning out money out of the **Stock Market**.

The methods used to analyze securities and make investment decisions fall into two very broad categories: fundamental analysis and technical analysis. Fundamental analysis involves analyzing the charac-



teristics of a company order to estimate its value. Technical analysis takes a completely different approach; it doesn't care one bit about the "value" of a company or a commodity. Technicians (sometimes called chartists) are only interested in the price movements in the market.

The term *Technical analysis* is used to mean fairly wide range of techniques, all based on the concept that past information on prices and trading volume of stocks gives the enlightened investor a picture of what lies ahead. It attempts to explain and forecast changes in security prices by studying only the market data rather than information about a company or its prospects as is done by fundamental analyst. John Magee, whose book *Technical Analysis of Stock Trends* is considered a classic for technical analysts, says :

"The technician has elected to study, not the mass of fundamentals, but certain abstraction, namely the market data alone. But this technical view provides a simplified and more comprehensible picture of what is happening to the price of a stock. It is like a shadow or reflection in which can be seen the broad outline of the whole situation. Furthermore, it works".

The technical analysts believe that the price of a stock depends on supply and demand in the market place and has little relationship to value, if any such concept even exists. Price is governed by basic economic and psychological inputs so numerous and complex that no individual can hope to understand and measure them correctly. The technician thinks that the only important information to work from is the picture given by price and volume statistics.

The technician sees the market, disregarding minor changes, moving in discernible trends which continue for significant periods. A trend is believed to continue until there is definite information of a change. The past performance of a stock can then be harnessed to predict the future. The direction of price change is as important as the relative size of the change. With his various tools, the technician attempts to correctly catch changes in trend and take advantage of them.

What Is Technical Analysis?

Technical analysis is a method of evaluating securities by analyzing the statistics generated by market activity, such as past prices and volume. Technical analysts do not attempt to measure a security's intrinsic value, but instead use charts and other tools to identify patterns that can suggest future activity.

Just as there are many investment styles on the fundamental side, there are also many different types of technical traders. Some rely on chart patterns, others use technical indicators and oscillators, and most use some combination of the two. In any case, technical analysts' exclusive use of historical price and volume data is what separates them from their fundamental counterparts. Unlike fundamental analysts, technical analysts don't care whether a stock is undervalued - the only thing that matters is a security's past trading data and what information this data can provide about where the security might move in the future.

BASIC TECHNICAL ASSUMPTIONS

Before we embark on the actual methods themselves, let us review the basic and necessary assumptions regarding the technical analysis:

1. The Market Discounts Everything

A major criticism of technical analysis is that it only considers price movement, ignoring the fundamental factors of the company. However, technical analysis assumes that, at any given time, a stock's price



reflects everything that has or could affect the company - including fundamental factors. Technical analysts believe that the company's fundamentals, along with broader economic factors and market psychology, are all priced into the stock, removing the need to actually consider these factors separately. This only leaves the analysis of price movement, which technical theory views as a product of the supply and demand for a particular stock in the market.

2. Price Moves in Trends

In technical analysis, price movements are believed to follow trends. This means that after a trend has been established, the future price movement is more likely to be in the same direction as the trend than to be against it. Most technical trading strategies are based on this assumption.

3. History Tends To Repeat Itself

Another important idea in technical analysis is that history tends to repeat itself, mainly in terms of price movement. The repetitive nature of price movements is attributed to market psychology; in other words, market participants tend to provide a consistent reaction to similar market stimuli over time. Technical analysis uses chart patterns to analyze market movements and understand trends. Although many of these charts have been used for more than 100 years, they are still believed to be relevant because they illustrate patterns in price movements that often repeat themselves.

Technical analysis and fundamental analysis are the two main schools of thought in the financial markets. As we've mentioned, technical analysis looks at the price movement of a security and uses this data to predict its future price movements. Fundamental analysis, on the other hand, looks at economic factors, known as fundamentals. Let's get into the details of how these two approaches differ, the criticisms against technical analysis and how technical and fundamental analysis can be used together to analyze securities.

The Critics on Technical Analysis

Some critics see technical analysis as a form of black magic. Don't be surprised to see them question the validity of the discipline to the point where they mock its supporters. In fact, technical analysis has only recently begun to enjoy some mainstream credibility. While most analysts on Wall Street focus on the fundamental side, just about any major brokerage now employs technical analysts as well.

Much of the criticism of technical analysis has its roots in academic theory - specifically the efficient market hypotheses (EMH). This theory says that the market's price is always the correct one - any past trading information is already reflected in the price of the stock and, therefore, any analysis to find undervalued securities is useless.

There are three versions of EMH. In the first, called weak form efficiency, all past price information is already included in the current price. According to weak form efficiency, technical analysis can't predict future movements because all past information has already been accounted for and, therefore, analyzing the stock's past price movements will provide no insight into its future movements. In the second, semi strong efficiency, fundamental analysis is also claimed to be of little use in finding investment opportunities. The third is strong form efficiency, which states that all information in the market is accounted for in a stock's price and neither technical nor fundamental analysis can provide investors with an edge. The vast majority of academics believe in at least the weak version of EMH, therefore, from their point of view, if technical analysis works, market efficiency will be called into question.

There is no right answer as to who is correct. There are arguments to be made on both sides and, therefore, it's up to you to do the homework and determine your own philosophy.

Some Important Techniques in Technical Analysis :

(A) FIBONACCI NUMBERS

Fibonacci numbers have intrigued mathematicians and scientists for hundreds of years. Leonardo Fibonacci (1170-1240) was a medieval mathematician who discovered the series of numbers while studying the reproductive behaviour of rabbits. The beginning of the Fibonacci series is shown below : 1,1,2,3,5,8,13,21,34,55,89,144,233,.....

After the initial pair of ones, each succeeding number is simply the sum of the previous two.

The remarkable thing about these numbers is the frequency with which they appear in the environment. Sunflowers have seed spiralling around the centre of the plant. Some spirals contain seeds leaning counter clockwise, with other spirals going the other way. On most sunflowers, the number of clockwise spirals and the number of counter clockwise spirals are adjacent Fibonacci numbers. A blossom might have 34 counter clockwise spirals and 55 clockwise spirals. The structure of pine cones, the number of chambers in a nautilus seashell, (Fig.3.1) the topology of spiralling galaxies, and the ancestry of bees all reveal Fibonacci numbers. Even a professional journal, the Fibonacci Quarterly, is devoted to the study of this series.

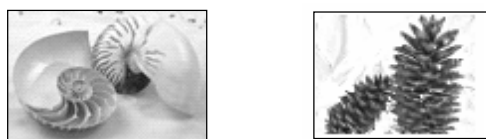


Fig. 3.1

- * Technical analysts who follow Fibonacci numbers usually make use of the number 1.618. This number is called the golden mean and appears in ancient writings and architecture. (The golden mean features prominently in the dimensions of the Parthenon). After the first ten or so numbers in the series, each Fibonacci number divided by its immediate predecessor equals 1.618. For example, $89/55 = 1.618$, $134/89 = 1.6189$, and so on. This magic number is used to calculate Fibonacci ratios as shown in Table 1.

TABLE 1 - Fibonacci Ratios

0/618	1	0.618	1.000	1.618	2.618
-	-	X	X	X	X
1.618	1.618	1.618	1.618	1.618	1.618
0.382	0.618	1.000	1.618	2.618	4.236



- * Many Fibonacci advocates in the investment business use the first two ratios, 0.382 and 0.618, to “compute retracement levels of a previous move”. For instance, a stock that falls from Rs. 50 to Rs. 35 (a 30 percent drop) will encounter resistance to further advances after it recoups 38.2 percent of its loss (that is, after it rises to Rs. 40.73).
- * Some technical analysts keep close tabs on resistance and support levels as predicted by the Fibonacci ratios. Even people who do not subscribe to this business know that many other people do, and that when stock prices approach important Fibonacci levels, unusual things can occur.
- * A male bee (a drone) has only a mother ; it comes from an unfertilized egg. A female bee (a queen) comes from a fertilized egg and has both a mother and a father. This means one drone has one parent, two grandparents, three great-grandparents, five great-great grandparents, and so on. The number of ancestors at each generation is the Fibonacci series.

ELLIOTT WAVE PRINCIPLE

One theory that attempts to develop a rationale for a long-term pattern in the stock price movements is the Elliott Wave Principle (EWP), established in the 1930s by R.N. Elliott and later popularized by Hamilton Bolton. The EWP states that major moves take place in five successive steps resembling tidal waves. In a major bull market, the first move is upward, the second downward, the third upward, the fourth downward and the fifth and final phase upward. The waves have a reverse flow in a bear market.

KONDRATEV WAVE THEORY

Nikolay Kondratev was a Russian economist and statistician born in 1892. He helped develop the first Soviet five-year plan. From 1920 to 1928 he was Director of the Study of Business Activity at the Timiriazev Agricultural Academy. While there he devoted his attention to the study of Western capitalists economies. In the economies of Great Britain and the United States, he identified long-term business cycles with a period of 50-60 years. He became well known after the U.S. market crash of 1929, which Kondratev predicted would follow the U.S. crash of 1870. His hypothesis of a long-term business cycle is called the *Kondratev Wave Theory*.

Note that the market crash for 1987 occurred 58 years after the crash of 1929, a period consistent with Kondratev’s theory. Some modern economists believe Kondratev’s theory has merit. Many other believe that significant macroeconomic changes, such as floating exchange rates, the elimination of the gold standard, and the reduction of barriers to free trade, make the decision cycle less predictable. Still, many market analysts consider Kondratev’s work in their assessment of the stock market and its risks.

CHAOS THEORY

At recent finance conferences, a few researchers have presented papers on chaos theory and its application to the stock market. In physics, chaos theory is growing field of study examining instances in which apparently random behaviour is, in fact, quite systematic or even deterministic. Scientists apply this theory to weather prediction, population growth estimates, and fisheries biology.



- * As an example of the latter application, a given volume of ocean water, left free from human interference, will not necessarily reach an equilibrium population of the various species that inhabit it. As fish grow, they consume the smaller fry (of their own or a different species) in increasing numbers. Fewer younger fishes are left to mature; this, coupled with the natural death of the older fish, eventually results in a sudden drastic reduction in fish population, causing dismay to fishermen and excitement in the local media. At the same time, it results in reduced predation and food competition by the surviving fry, so the population begins to grow dramatically, and the cycle continues. Interactions between species add complexity to the process.
- * Investment analysts have sought a pattern in stock market behavior since the origin of the exchanges. Much remains unknown about how security prices are determined, and chaos theory may eventually provide some potential answers. If the apparent randomness of security price changes, can be shown to be nonrandom, much of the theory of finance would need revision.

NEUTRAL NETWORKS

A *neutral network* is a trading system in which a forecasting model is trained to find desired output from past trading data. By repeatedly cycling through the data, the neutral network eventually learns the pattern that produces the desired output. If the desired output remains elusive, more data is included until a pattern is found. Neutral networks may also include a feedback mechanism whereby experience is gained from past errors.

- * This topic is a hot one in the investment community. National conferences have been organized dealing exclusively with this topic, and the trade literature publishes many articles on the topic. A problem with concept of a neutral network is that the stock market is seldom deterministic. Situations constantly change, and what may have been true a few years ago will not necessarily prevail tomorrow. Financial academics are especially leery of backtests, or research that tests a hypothesis using past data. Mining the data will almost always result in some apparent cause and effect between past events and stock market performance. Research that tests a hypothesis using subsequent data is much more useful. An article in the popular press describes Wall Street's response to this criticism:
- * One way to get around this hazard is to build something called a genetic algorithm into your neutral network. A sexy term that currently causes Wall Street rocket scientists to swoon, genetic algorithms enable neutral nets to adapt to the future by spawning schools of baby nets, each of which is sent to swim against the changing flow of data, where only the fittest survive to take over the role of the mother.
- * No matter what someone's field of study, they are interested in the search for a better mousetrap. Essentially, what all security analysts seek to do is to find improvements in their methodology for security selection.

TOOLS OF TECHNICAL ANALYSIS

The technicians must (1) identify the trend, (2) recognize when one trend comes to an end and prices start in the opposite direction. His central problem is to distinguish between reversals

within a trend and real changes in the trend itself. This problem of sorting out price changes is critical since prices do not change in a smooth, uninterrupted fashion.

The two variables concerning groups of stocks or individual stocks are :

- (1) Behaviour of prices, and
- (2) Volume of trading contributing to and influenced by changing prices.

The use of technical “indicators” to measure the direction of overall market should precede any technical analysis of individual stocks, because of systematic influence of the general market on stock prices. In addition some technicians feel that forecasting aggregates is more reliable, since individual errors can be filtered out.

First, we will examine the seminal theory from which much of the substances of technical analysis has been developed – the Dow theory – after which they key indicators viz., price and volume relating to entire market and individual stock performance as shown in Table 2 will be examined.

Tools of Technical Analysis

Category	Market Indicators	Market and individual stock indicators
Price indicators	Dow theory Breadth of Market Indicators ○ Plurality ○ Market breadth index ○ Advance –Declines ○ New highs and new lows ○ The most active list ○ Confidence indicator (Disparity index)	Line, bar and point and figure charges Moving averages. Relative strength
Volume indicators	New York & American Exchange volume Contrary Opinion Theories ○ Short selling ○ Odd Lot trading	Resistance & support charts Price volume bar charts
Other indicators	Mutual fund activity Credit balance theory	

DOW THEORY

The Dow theory is one of the oldest and most famous technical tools. It was originated by Charles Dow, who founded the Dow Jones company and was the editor of The Wall Street journal, Mr. Dow died in 1902. The Dow theory was developed by W.P. Hamilton and Robert



Rhea from the editorial written by Dow during 1900-1902 years, numerous writers have altered, extended and in some cases abridged the original Dow theory. It is the basis for many other techniques used by technical analysts.

The Dow theory is credited with having forecast the Great Crash of 1929. On October 23, 1929. The Wall Street Journal published a still famous editorial. "A Twin in the Tide" which correctly stated that the bull market was then over and a bear market had started. The horrendous market crash which followed the forecast drew much favourable attention to the Dow theory. Greiner and Whitecomb assert that "The Dow Theory provides a time tested method of reading the stock market barometer". There are many versions of this theory, but essentially it consists of three types of market movements : the major market trend, which can often last a year or more; a secondary intermediate trend, which can move against the primary trend for one to several months ; and minor movements lasting only for hours to a few days. The determination of the major market trend is the most important decision to the Dow believer. The Theory : According to Dow, "The market is always considered as having three movement, all going at the same time. The first is the narrow movement from day to day. The second is the short swing running from two weeks to a month or more, the third is the main movement covering atleast four years in duration". These movements are called -

- **Daily fluctuations (minor trends)**
- **Secondary movements (trends), and**
- **Primary trends**

The primary trends is the long range cycle that carries the entire market up or down (bull or bear markets). The secondary trend acts as a restraining force on the primary trend. It ends to correct deviations from its general boundaries. The minor trends have little analytical value, because of their short duration and variations in amplitude. Figure 1 represents Dow theory. The Dow theory is built upon the assertion that measures of stock prices tend to move together. It employs two of the Dow Jones averages.

- (i) Dow-Jones Transportation Average (DJTA)
- (ii) Dow-Jones Industrial Average (DJIA)

Bear market – If both the averages are rising

Bear market – If both the averages are falling

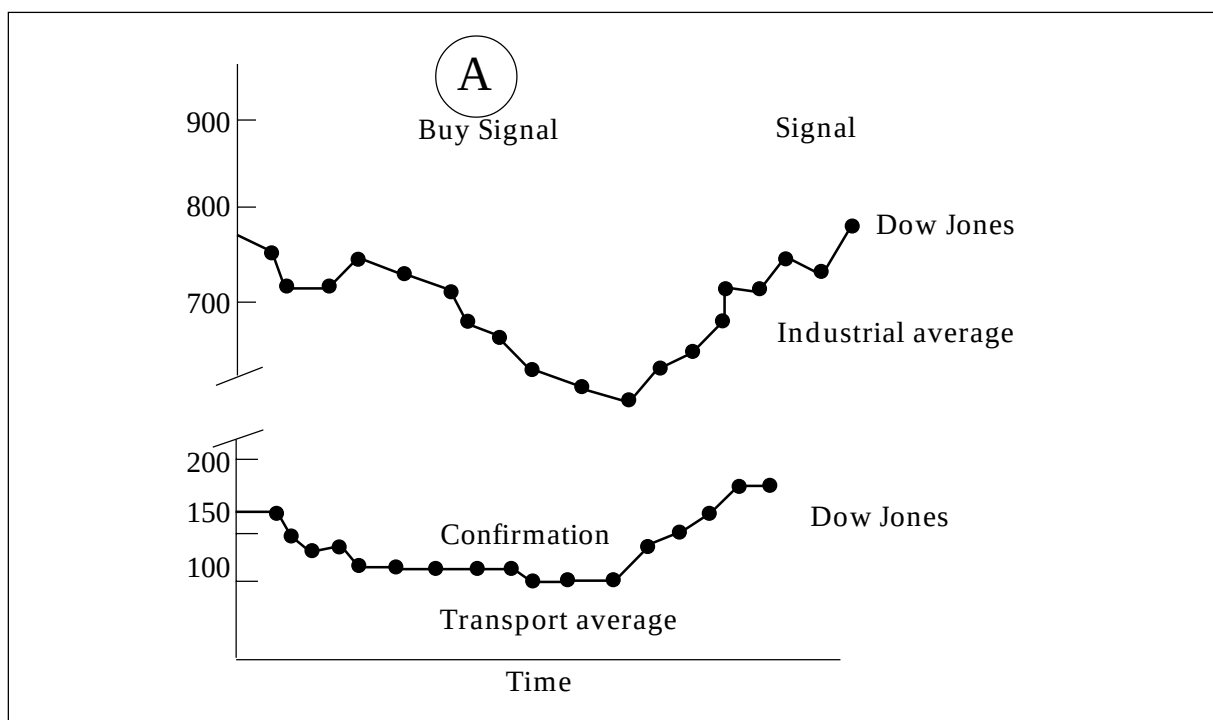
Uncertain - If one is rising and other is falling

Although Charles Dow believed in fundamental analysis, the Dow theory has evolved into a primarily technical approach to the stock market. It asserts that stock prices demonstrate patterns over four to five years and these patterns are mirrored by indices of stock prices. The Dow Theory employs two of the Dow Jones averages, the Industrial average and the transportation average. The utility average is generally ignored.

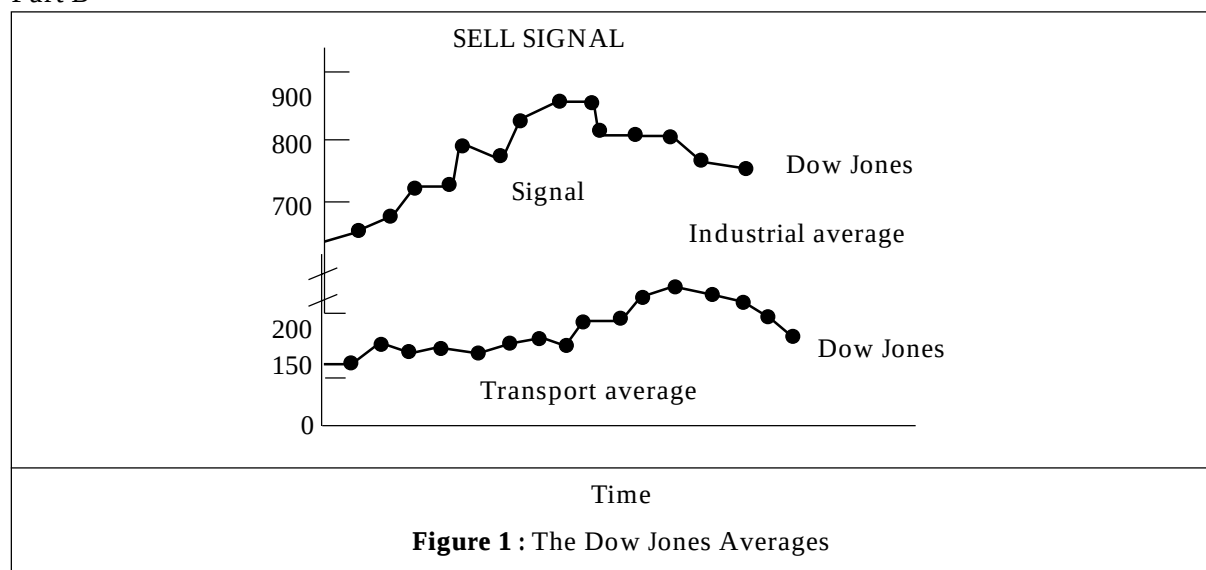
The Dow theory is built upon the assertion that measures of stock prices tend to move together. If the Dow Jones industrial average is rising, then, the transportation average and the

transportation average. The utility average is rising, then, the transportation average should also be rising. Such simultaneously price movements suggest a strong bull market. Conversely, a decline in both the industrial and transportation averages are moving in opposite directions, the market is uncertain as to the direction of future stock prices. If one of the averages starts to decline after a period of rising stock prices, then the two are at odds. For example, the industrial average may be rising while the transportation average is falling. This suggests that the industrials may not continue to rise but may soon start to fall. Hence, the market investor will use this signal to sell securities and convert to cash.

The converse occurs when after a period of falling security prices one of the averages starts to rise while the other continue to fall. According to the Dow Theory, this divergence suggests that this phase is over and that security prices in general will soon start to rise. The astute investor will then purchase securities in anticipation of the price increase. These signals are illustrated in Fig.1. Part A illustrates a buy signal. Both the industrial and transportation average have been declining when the industrial starts to rise. Although the transportation index is still declining, the increase in industrial average suggests that the declining market is over. This change is then confirmed when the transportation average also starts to rise.



Part B

**Criticism on Dow theory:**

Several criticisms are levelled against the Dow theory.

1. It is not a theory but an interpretation of known data. A theory should be able to explain why a phenomenon occurs. No attempt was made by Dow or his followers to explain why the two averages should be able to forecast future stock prices.
2. It is not acceptable in its forecast. There was considerable lag between the actual turning points and those indicated by the forecast.
3. It has poor predictive power. According to Rosenberg, the Dow theory could not forecast the bull market which had preceded the 1929 crash. It gave bearish indication in early 1926. The 31/2 years which followed the forecast of Hamilton's editorials for the 26-year period, from 1904 to 1929. Of the 90 recommendations Hamilton made for a change in attitude towards the market (55% were bullish, 18% bearish and 29% doubtful) only 45 were correct. Such a result an investor may get by flipping a coin).

CRITICISMS OF TECHNICAL ANALYSIS

Despite the assertions of technical analysis, technical analysis is not a sure-fire method. The various limitations of technical pointed out by its critics are as given under :

- i) Difficult in interpretation :** Technical analysis is not as simple as it appears to be. While the charts are fascinating to look at, interpreting them correctly is very difficult. It is always easy to interpret the charts long after the actual point of time. As such, fundamentals argue that charting techniques are no different from palmistry.
- ii) Frequent changes :** Technical analysis is not as simple as it appears to be. While the charts are fascinating to look at, interpreting them correctly is very difficult. It is always easy to interpret the charts long after the actual point of time.
- ii) Frequent changes :** With changes in market, chart patterns keep on changing. Accordingly,

technical analysts change their opinions about a particular investment very frequently. One day they put up a buy signal. A couple of weeks later, they see a change pattern and put up a sell signal.

- iii) **Unreliable changes** : Changes in market behaviour observed and studied by technical analyst may not always be reliable owing to ignorance or intelligence or manipulative tendencies of some participants.
- iv) **Judgemental Bias**: A false piece of information or wrong judgment may result in trade at a lower than market price. If the technicians fail to wait for confirmation, they incur losses.

THE FUTURE OF TECHNICAL ANALYSIS

Although there is much in finance that we do not completely understand, technical analysis has persisted for more than 100 years, and it is not likely to disappear from the investment scene anytime soon. Improved quantitative methods coupled with improved behavioural research will continue to generate ideas for analysts to test. The well-known financial behaviourist Warner De Bont, for instance, recently reported substantial evidence that the public expects the continuation of past price trends. That is, they are bullish in bull markets and pessimistic in bear markets. Perhaps within a decade or more, the fragmentation of technical analysis into such a wide-ranging array of increasingly complex, widely differing formulae will cause a gradual movement away from the entire quasi-science back to some form of more fundamental evaluation.

Key words

- Fundamental analysis
- Technical analysis
- Industry analysis
- Economy analysis
- Company analysis
- Return
- EPS
- P / E Ratio
- Dow Theory
- Charts
- Price indicators

Summary

A commonly advocated procedure for fundamental analysis involves a 3 – step analysis: macroeconomic analysis, industry analysis, and company analysis. In a globalised business environment, the top-down analysis of the prospects of a firm must begin with the global economy. There are two broad classes of macroeconomic policies, viz. demand side policies and supply side policies. Fiscal and monetary policies are the two major tools of demand side economics. Fiscal policy is concerned with the spending and tax initiatives of the government. Monetary policy is concerned with money supply and interest rates. The macroeconomy is the overall economic environment in which all firms operate.



The term *Technical analysis* is used to mean fairly wide range of techniques, all based on the concept that past information on prices and trading volume of stocks gives the enlightened investor a picture of what lies ahead. It attempts to explain and forecast changes in security prices by studying only the market data rather than information about a company or its prospects as is done by fundamental analyst. John Magee, whose book *Technical Analysis of Stock Trends* is considered a classic for technical analysts, says “The technician has elected to study, not the mass of fundamentals, but certain abstraction, namely the market data alone.

Fundamentalists study the cause, not the “should”. They make their decisions on quality, value and depending on their specific investment goals, the yield or growth potential of the security. They are concerned with the basis, the corporation’s financial strength, record of growth in sales and earnings, profitability, the investment acceptance and so on. They also take into account the general business and market conditions. Finally they interpret these data inductively to determine the current value of the stock and then to project its future price. Fundamentalists are patient and seldom expect meaningful profits in less than one year.

The technicians must (1) identify the trend, (2) recognize when one trend comes to an end and prices start in the opposite direction. His central problem is to distinguish between reversals within a trend and real changes in the trend itself. This problem of sorting out price changes is critical since prices do not change in a smooth, uninterrupted fashion. The two variables concerning groups of stocks or individual stocks are : (1) Behaviour of prices, and (2) Volume of trading contributing to and influenced by changing prices. One school of thought led by William L. Jiler developed a comprehensive technique called “Chart Reading”. Charts provide visual assistance detecting the emerging and changing patterns and changing patterns of price behaviour. Technical analysts use three basic type of charts. Line Charts, Bar Charts, Point and Figure Charts The trouble with most chart patterns is that they cause their followers to change their opinion so frequently. Most chart service change like the wind. One day they put out a strong buy signal, two weeks later, they see a change in the pattern and tell their clients to sell, then two weeks later, they tell them to buy again. The result is that these patterns force their followers in and out of the market time and time again. Though this is great for brokers’ commission, but not so great for the investor. Most of the technical indicators make sense when examined individually but when once examines many technical indicators simultaneously, the interpretation of their collective meaning is often contradictory and confusing. Once technical analyst issued the following report : The breadth of the market remains pretty bearish, but the odd-lot index is still in balance and is more bullish than bearish. While the short interest is not bearish, brokers loans are at a dangerously high level.

Short questions :

1. Define fundamental analysis.
2. Mention the basic assumptions of Technical analysis.
3. What is economic forecasting?
4. Define EIC analysis?
5. Define Diffusion index?
6. What are the factors which influences on economic analysis?



7. What are the Opportunities and threats in macro economic Environment? Explain in detail.
8. Write a brief note on technical analysis and Assumptions
9. What is the difference between Technical and Fundamental analysis
10. Write Origins and Development of Technical analysis
11. What are the Techniques of Technical analysis?
12. What do you mean Market indicators?
13. Write a short note on Old Puzzles and New Developments: Fibonacci Numbers, The Dow Theory, Elliott wave Principles; Kondratev Wave Theory, Chaos theory, neutral Net works
14. Write on Charting as a Technical Tools: Types of charts, Important chart patterns
15. Define and explain Moving Average Convergence Divergence (MACD)
16. Write on major uses of moving averages. What are the Technical analysis indicators and oscillators?
17. Define an oscillator
18. Write on Relative Strength Index
19. What are the Limitations of charts and Criticisms of technical analysis
20. Write on the future of technical analysis

Objective questions:

1. In a major bull market move there takes place five successive movements, according to _____ principle (Kondratev ; Elliott ; Chaos)
 1. _____ analysis is based on past information of prices and trading volume of stocks. (Economic ; Fundamental ; Technical)
 3. _____ developed a comprehensive technique called “Chart Reading”. **(William L. Jiler ; Rosenberg ; Charles Dow)**
 4. _____, for instance, recently reported substantial evidence that the public **expects the continuation of past price trends. (Warner De Bont ; Nikolay Kondratev ; Hamilton Bolton)**
 5. _____ is to measure the intrinsic value of a stock with the help of the company’s financial information. (Fundamental analysis; Technical analysis ; Industry analysis)
 6. _____ identified long-term business cycles with a period of 50-60 years. **(Kondratev ; Dow theory ; Moving Average)**

[Answers : Objective questions : 1. b ; 2. b ; 3. a ; 4. a ; 5. a ; 6. a]

3.4 CAPITAL ASSET PRICING MODEL

Introduction to CAPM

William F. Sharpe and John Litner developed the Capital Asset Pricing Model (CAPM). The model is based on the portfolio theory developed by Harry Markowitz. The model emphasises



the risk factor in portfolio theory which is a combination of two risks, systematic risk and unsystematic risk. The model suggests that a security's return is directly related to its systematic risk which cannot be neutralised through diversification. The combination of both types of risks stated above provides the total risk. The total variance of returns is equal to market related variance plus company's specific variance. CAPM explains the behaviour of security prices and provides a mechanism whereby investors could assess the impact of a proposed security investment on the overall portfolio risk and return. CAPM suggests that the prices of securities are determined in such a way that the risk premium or excess return are proportional to systematic risk, which is indicated by the beta coefficient. The model is used for analysing the risk-return implications of holding securities.

CAPM vs. Other Market Models

CAPM refers to the way in which securities are valued in line with their anticipated risks and returns. A risk averse investor prefers to invest in risk free securities. A small investor having few securities in his portfolio, risk is greater. To reduce the unsystematic risk, he must build up well diversified securities in his portfolio.

The asset return depends on the amount for the asset today. The price paid must ensure that the market portfolio's risk / return characteristics improve when the asset is added to it. The CAPM is a model which derives the theoretical required return (i.e. discount rate) for an asset in a market, given the risk-free rate available to investors and the risk of the market as a whole.

The CAPM is usually expressed:

$$E(R_i) = R_f + \beta_i (E(R_m) - R_f)$$

↳ Beta, is the measure of asset sensitivity to a movement in the overall market; Beta is usually found via regression on historical data. Betas exceeding one signify more than average "riskiness"; betas below one indicate lower than average.

$(E(R_m) - R_f)$ is the market premium, the historically observed excess return of the market over the risk-free rate.

Once the expected return, $E(r_i)$, is calculated using CAPM, the future cash flows of the asset can be discounted to their present value using this rate to establish the correct price for the asset. *(Here again, the theory accepts in its assumptions that a parameter based on past data can be combined with a future expectation.)*

Assumptions of CAPM

Assumptions to Capital Asset Pricing Model

Because the CAPM is a theory, we must assume for argument that...

1. All assets in the world are traded
2. All assets are infinitely divisible
3. All investors in the world collectively hold all assets
4. For every borrower, there is a lender
5. There is a riskless security in the world

6. All investors borrow and lend at the riskless rate
7. Everyone agrees on the inputs to the Mean-STD picture
8. Preferences are well-described by simple utility functions
9. Security distributions are normal, or at least well described by two parameters
10. There are only two periods of time in our world

The asset return depends on the amount for the asset today. The price paid must ensure that the market portfolio's risk / return characteristics improve when the asset is added to it. The CAPM is a model which derives the theoretical required return (i.e. discount rate) for an asset in a market, given the risk-free rate available to investors and the risk of the market as a whole.

A more risky stock will have a higher beta and will be discounted at a higher rate; less sensitive stocks will have lower betas and be discounted at a lower rate. In theory, an asset is correctly priced when its observed price is the same as its value calculated using the CAPM derived discount rate. If the observed price is higher than the valuation, then the asset is overvalued; it is undervalued for a too low price.

Mathematically:

- (1) The incremental impact on risk and return when an additional risky asset, **a**, is added to the market portfolio, **m**, follows from the formulae for a two asset portfolio. These results are used to derive the asset appropriate discount rate.

$$\text{Risk} = (W_m^2 \sigma_m^2 + [W_m^2 \sigma_m^2 + 2W_m W_a \rho_{am} \sigma_a \sigma_m])$$

$$\text{Hence, risk added to portfolio} = [W_m^2 \sigma_m^2 + 2W_m W_a \rho_{am} \sigma_a \sigma_m]$$

but since the weight of the asset will be relatively low, $W_m^2 \approx 0$

$$\text{i.e. additional risk} = [2W_m W_a \rho_{am} \sigma_a \sigma_m]$$

$$\text{Return} = (W_m E(R_m) + [W_a E(R_a)])$$

$$\text{Hence additional return} = [W_a E(R_a)]$$

- (2) If an asset, **a**, is correctly priced, the improvement in risk to return achieved by adding it to the market portfolio, **m**, will at least match the gains of spending that money on an increased stake in the market portfolio. The assumption is that the investor will purchase the asset with funds borrowed at the risk-free rate, R_f ; this is rational if

$$E(R_a) > R_f$$

Thus

$$[W_a (E(R_a) - R_f)] / [2W_a W_a \rho_{am} \sigma_a \sigma_m] = [W_a (E(R_m) - R_f)] / [2W_m W_a \sigma_m \sigma_m]$$

$$\text{i.e. : } [E(R_a)] = R_f + [E(R_m) - R_f] * [\rho_{am} \sigma_a \sigma_m] / [\sigma_m \sigma_m]$$

$$\text{i.e. : } [E(R_a)] = R_f + [E(R_m) - R_f] * [\sigma_{am}] / [\sigma_{mm}]$$



$[\sigma_{am}]/[\sigma_{mm}]$ is the “beta”, $\hat{a}$ — the covariance between the asset and the market compared to the variance of the market, i.e. the sensitivity of the asset price to movement in the market portfolio. This is a long list of requirements, and together they describe the capitalist’s ideal world. **Everything** may be bought and sold in perfectly liquid fractional amounts. There is a perfect, safe haven for risk-averse investors i.e. the riskless asset. This means that everyone is an equally good credit risk! No one has any informational advantage in the CAPM world. Everyone has already generously shared all of their knowledge about the future risk and return of the securities, so no one disagrees about expected returns. All customer preferences are an open book — risk attitudes are well described by a simple utility function. There is no mystery about the shape of the future return distributions. Last but not least, decisions are not complicated by the ability to change your mind through time. You invest irrevocably at one point, and reap the rewards of your investment in the next period — at which time you and the investment problem cease to exist. Terminal wealth is measured at that time. I.e. he who dies with the most toys wins! The technical name for this setting is “A frictionless one-period, multi-asset economy with no asymmetric information.”

Investment Implications

CAPM tells us that all investors will want to hold “capital-weighted” portfolios of global wealth. In the 1960’s when the CAPM was developed, this solution looked a lot like a portfolio that was already familiar to many people: the S&P 500. The S&P 500 is a capital-weighted portfolio of most of the U.S.’s largest stocks. At that time, the U.S. was the world’s largest market, and thus, it seemed to be a fair approximation to the “cake.” Amazingly, the answer was right under our noses — the tangency portfolio must be something like the S&P 500! Not co-incidentally, widespread use of index funds began about this time. Index funds are mutual funds and/or money managers who simply match the performance of the S&P. Many institutions and individuals discovered the virtues of indexing. Trading costs were minimal in this strategy: capital-weighted portfolios automatically adjust to changes in value when stocks grow, so that investors need not change their weights all the time — it is a “buy-and-hold” portfolio. There was also little evidence at the time that active portfolio management beat the S&P index — so why not?

Is the CAPM true?

Any theory is only strictly valid if its assumptions are true. There are a few nettlesome issues that call into question the validity of the CAPM:

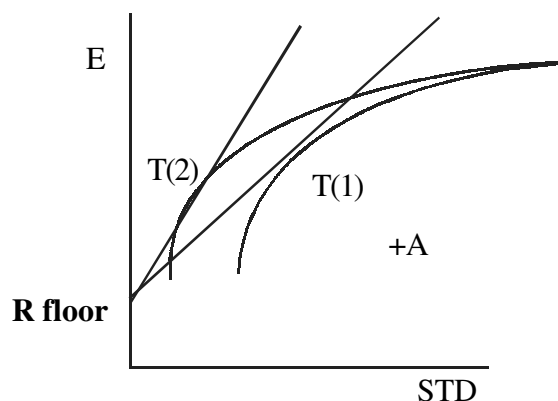
- Is the world in equilibrium?
- Do **you** hold the value-weighted world wealth portfolio?
- Can you even come close?
- What about “human capital?”

While these problems may violate the letter of the law, perhaps the spirit of the CAPM is correct. That is, the theory may be a good prescription for investment policy. It tells investors to choose a very reasonable, diversified and low cost portfolio. It also moves them into global assets, i.e.

towards investments that are not too correlated with their personal human capital. In fact, even if the CAPM is approximately correct, it will have a major impact upon how investors regard individual securities. Why?

Portfolio Risk

Suppose you were a CAPM-style investor holding the world wealth portfolio, and someone offered you another stock to invest in. What rate of return would you demand to hold this stock? The answer before the CAPM might have depended upon the standard deviation of a stock's returns. After the CAPM, it is clear that you care about the effect of this stock on the TANGENCY portfolio. The diagram shows that the introduction of asset A into the portfolio will move the tangency portfolio from T(1) to T(2).



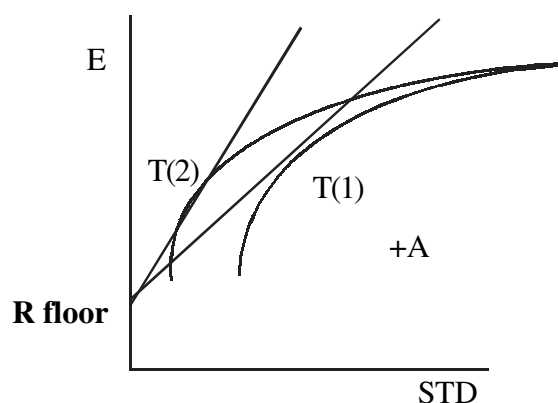
The extent of this movement determines the price you are willing to pay (alternately, the return you demand) for holding asset A. The lower the average correlation A has with the rest of the assets in the portfolio, the more the frontier, and hence T, will move to the left. This is good news for the investor — if A moves your portfolio left, you will demand lower expected return because it improves your portfolio risk-return profile. This is why the CAPM is called the “Capital Asset **Pricing** Model.” It explains relative security prices in terms of a security's contribution to the risk of the whole portfolio, not its individual standard deviation.

The CAPM is a theoretical solution to the identity of the tangency portfolio. It uses some ideal assumptions about the economy to argue that the capital weighted world wealth portfolio is the tangency portfolio, and that every investor will hold this same portfolio of risky assets. Even though it is clear they do not, the CAPM is still a very useful tool. It has been taken as a prescription for the investment portfolio, as well as a tool for estimating an expected rate of return. In the next chapter, we will take a look at the second of these two uses.

Further Explorations of the Capital Asset Pricing Model

I. Risk-Return Tradeoff: A Technical Aside

Recall from last chapter that, when investors are well-diversified, they evaluate the attractiveness of a security based upon its contribution to portfolio risk, rather than its volatility *per se*. The intuition is that an asset with a low correlation to the tangency portfolio is desirable, because it shifts the frontier to the left.



This institution was formalized by Stephen Ross in an article called *Finance*, published in *The New Palgrave*. It is a simple argument that shows the theoretical basis for the “pricing” part of the Capital Asset Pricing Model.

Here goes: Suppose you are an investor who holds the market portfolio m and you are considering the purchase of a quantity dx of asset A , by financing it via borrowing at the riskless rate. This augments the return of the market portfolio by the quantity:

$$dE_m = [E_A - R_f]dx$$

Where d symbolizes a small quantity change. This investment also augments the variance of the market portfolio. The variance of the market portfolio after adding the new asset is:

$$v + dv = v + 2dx \text{ cov}(A,m) + (dx)^2 \text{ var}(a)$$

The change in the variance is then:

$$dv = 2 dx \text{ cov}(A,m) + (dx)^2 \text{ var}(A)$$

For small dx 's this is approximately:

$$dv = 2 dx \text{ cov}(A,m)$$

This gives us the risk-return tradeoff to investing in a small quantity of A :
Risk-Return Tradeoff for $A = dE_m/dv = [E_A - R_f]/2 dx \text{ cov}(A,m)$

$$\text{Risk-Return Tradeoff for } A = dE_m/dv = [E_A - R_f]/2 \text{ cov}(A,m)$$

Now, if the expected return of asset A is in equilibrium, then an investor should be indifferent between augmenting his or her portfolio with a quantity of A and simply leveraging up the existing market portfolio position. If this were NOT the case, then either the investor would not be willing to hold A , or A would dominate the portfolio entirely. We can calculate the same Risk-Return Tradeoff for buying dx quantity of the market portfolio P instead of security A .

$$\text{Risk-Return Tradeoff for } P = dE_m/dv = [E_m - R_f]/2 \text{ var}(m)$$

The equations are almost the same, except that the $\text{cov}(A,m)$ is replaced with $\text{var}(m)$. This is because the covariance of any security with itself is the variance of the security. These Risk-Reward Tradeoffs must be equal:

$$[E_A - R_f]/2 \text{ cov}(A,m) = [E_m - R_f]/2 \text{ var}(m)$$

Thus, $[E_A - R_f] = [\text{cov}(A, m) / \text{var}(m)] [E_m - R_f]$

The value $\text{cov}(A, m) / \text{var}(m)$ is also known as the β of A with respect to m. β is a famous statistic in finance. It is functionally related to the correlation and the covariance between the security and the market portfolio in the following way:

$$\beta = \rho_{i,m} \frac{\sigma_i}{\sigma_m} = \frac{\sigma_{i,m}}{\sigma_m^2}$$

II. A Model of Expected Returns

In the preceding example, notice that we used the expression *expected* returns. That is, we found an equation that related the expected future return of asset A (in excess of the riskless rate) to the expected future return of the market (in excess of the riskless rate). This expected return is the return that investors will demand when asset prices are in the equilibrium described by the CAPM. For any asset i, the CAPM argues that the appropriate rate at which to discount the cashflows of the firm is that same rate that investors demand to include the security in their portfolio:

$$E[R_i] = R_f + \beta_i (E[R_m] - R_f)$$

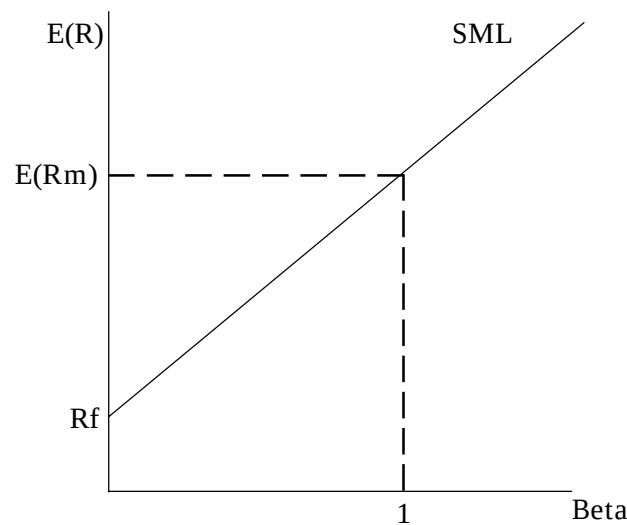
One surprising thing about this equation is what is **not** in it. There is no measure of the security's own standard deviation. The CAPM says that you do not care about the volatility of the security. You only care about its beta with respect to the market portfolio! Risk is now re-defined as the quantity of exposure the security has to fluctuations in the market portfolio.

Assessing the CAPM

The CAPM is a classical model in finance. It is an equilibrium argument that, if true, answers most important investment questions. It tells us where to invest, how to invest and what discount rate to use for project cash flows. Not only that, it is a disarmingly simple model. The expected return of a security depends upon a simple statistic: β . The relationship between risk and return is linear. Calculation of portfolio risk is trivial. At the same time, the CAPM is revolutionary. It tells us that the variance of a project is NOT a factor in determining the appropriate, risk-adjusted discount rate. It turns financial research from roll-up-your-sleeves fundamental analysis into a statistics problem. In short, the CAPM turned Wall Street on its head.

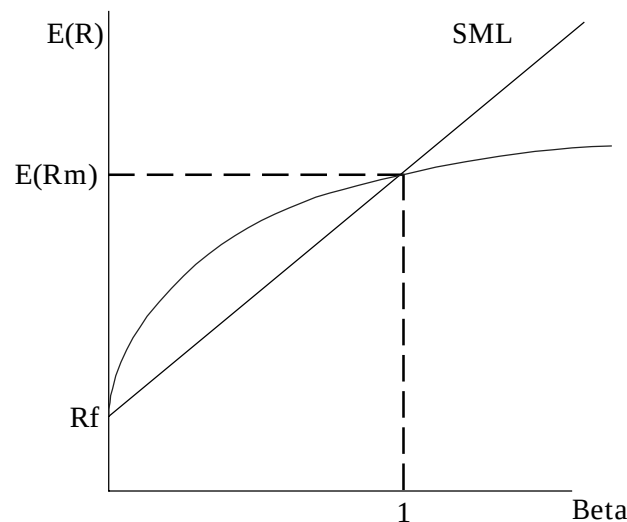
Security Market Line (SML)

The CAPM equation describes a linear relationship between risk and return. Risk, in this case, is measured by beta. We may plot this line in mean and β space: The security Market Line (SML) expresses the basic theme of the CAPM i.e., expected return of a security increases linearly with risk, as measured by 'beta'. The SML is an upward sloping straight line with an intercept at the risk free return securities and passes through the market portfolio. The upward slope of the line indicates that greater expected returns accompany higher levels of beta. In equilibrium, each security or portfolio lies on the SML figure 33.3 shows that the return expected from portfolio or investment is a combination of risk free return plus risk premium. An investor will come forward to take risk only if the return on investment also includes risk premium. CAPM provides an intuitive approach for thinking about the return that an investor should require on an investment, given the asset's systematic or market risk.



One remarkable fact that comes from the linearity of this equation is that we can obtain the beta of a **portfolio** of assets by simply multiplying the betas of the assets by their portfolio weights. For instance the beta of a 50/50 portfolio of two assets, one with a beta of .8 and the other with a beta of 1 is .9. Easy The line also extends out infinitely to the right, implying that you can borrow infinite amounts to lever up your portfolio.

Why is the line straight? Well, suppose it curved, as the blue line does in the figure below. The figure shows what could happen. An investor could borrow at the riskless rate and invest in the market portfolio. Any investment of this type would provide a higher expected return than a security which lies on the curved line below. In other words, the investor could receive a higher expected return for the same level of systematic risk. In fact, if the security on the curve could be sold short, then the investor could take the proceeds from the short sale and enter into the levered market position –



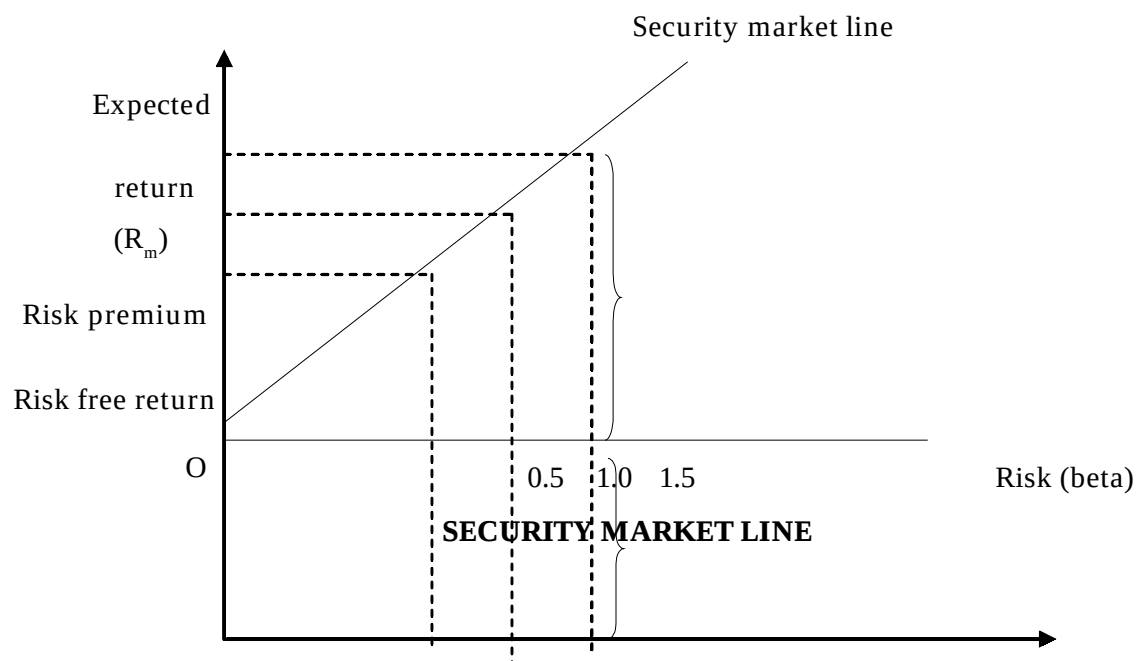
generating an arbitrage in expectation.

Expectations vs. Realizations

It is important to stress that the vertical dimension in the security market line picture is **expected** return. Things rarely turn out the way you expect. However, the CAPM equation also tells us about the **realized** rate of return. Since the realization is just the expectation plus random error, we can write:

$$R_i = R_f + \beta_i [R_m - R_f] + e_i$$

This is useful, because it tells us that when we look at past returns, they will typically deviate from the security market line — not because the CAPM is wrong, but because random error will push the returns off the line. Notice that the realized R_m does not have to behave as expected, either. So, even the slope of the security market line will deviate from the average equity risk premium. Sometimes it will even be negative!



CAPM shows the risk and return relationship of an investment in the formula given below:

$$E(R_i) = R_f + \beta_i (R_m - R_f)$$

Where,

$E(R_i)$ = Expected rate of return on any individual security (or portfolio of securities)

R_f = Risk free rate of return

R_m = Expected rate of return on the market portfolio

$R_m - R_f$ = Risk Premium

β_i = Market sensitivity index of individual security (or portfolio of securities)



Capital Market Line (CML)

The Markowitz mean-variance model is modified by introducing into the analysis the concept of risk-free asset. If it is assumed that the investor has access to risk-free securities (for example, Treasury bills) in addition to the universe of risky securities, then he can construct a new set of portfolios as depicted by the line R_fM . At point R_f the investor is investing all his investible fund in risk-free securities, whilst at point M he is holding an all-equity portfolio. The combination of risk-free investment and risky investments in portfolio which may be achieved by points between these two limits are termed 'lending portfolios'. Let us now assume that the investor can lend and borrow funds at the same risk-free interest rate. In such circumstances the efficiency boundary simply becomes the straight line drawn from R_f which is a tangent to the original risky portfolio efficiency boundary. The efficiency boundary that arises out of this assumption of the identical risk free lending and borrowing rates leads to some very important conclusions and is termed as 'Capital Market Line' (CML).

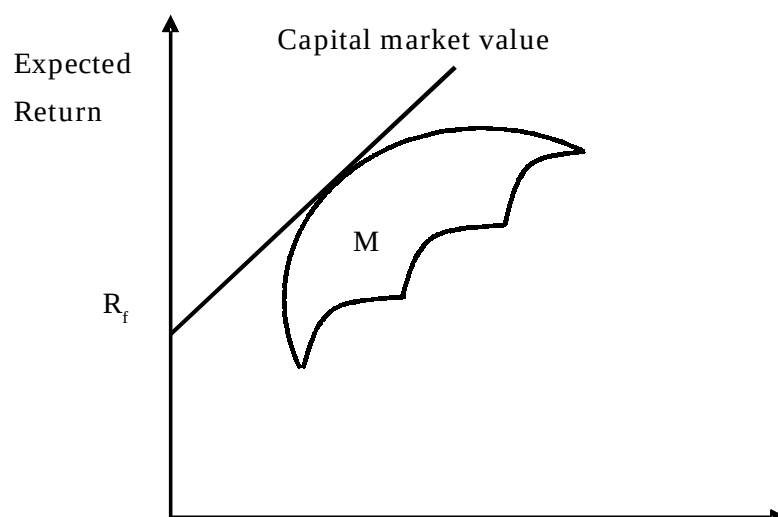


Illustration 4

Dummy Ltd., an investment company has invested in equity shares of a blue chip company. It's Risk free rate of return (R_f) = 10% , Expected total return (R_m) = 16%, Market sensitivity index (β) = 1.50, (of individual security)

Calculate the expected rate of return on the investment made in the security.

Solutions;

$$\begin{aligned}
 \text{Total expected return } (R_m) &= 16\% \\
 \text{Risk free return } (R_f) &= 10\% \\
 \text{Risk premium } (R_m - R_f) &= 6\% \\
 E(R_i) &= R_f + \beta_i(R_m - R_f) \\
 10 + 1.50(16-10) &= 19\%
 \end{aligned}$$

Illustration 5

Mr. Rakesh provides you following information compute expected return by using CAPM

$$R_m = 16\% \quad R_f = 9\% \quad b_1 = 0.8$$

Solutions;

The expected return on portfolio

$$\begin{aligned} E(R_1) &= R_f + b_1(R_m - R_f) \\ &= 9 + 0.8(16-9) = 14.6\% \end{aligned}$$

Characteristic Line

A rational investor would not invest in an asset which does not improve the risk-return characteristics of his existing portfolio. Since a rational investor would hold the market portfolio, the asset in question will be added to the market portfolio. MPT derives the required return for a correctly priced asset in this context.

Specific risk is the risk associated with individual assets - within a portfolio these risks can be reduced through diversification (specific risks “cancel out”). Systematic risk, or market risk, refers to the risk common to all securities - except for selling short as noted below, systematic risk cannot be diversified away (within one market). Within the market portfolio, asset specific risk will be diversified away to the extent possible. Systematic risk is therefore equated with the risk (standard deviation) of the market portfolio.

Since a security will be purchased only if it improves the risk / return characteristics of the market portfolio, the risk of a security will be the risk it adds to the market portfolio. In this context, the volatility of the asset, and its correlation with the market portfolio, is historically observed and is therefore a given (there are several approaches to asset pricing that attempt to price assets by modelling the stochastic properties of the moments of assets' returns - these are broadly referred to as conditional asset pricing models). The (maximum) price paid for any particular asset (and hence the return it will generate) should also be determined based on its relationship with the market portfolio.

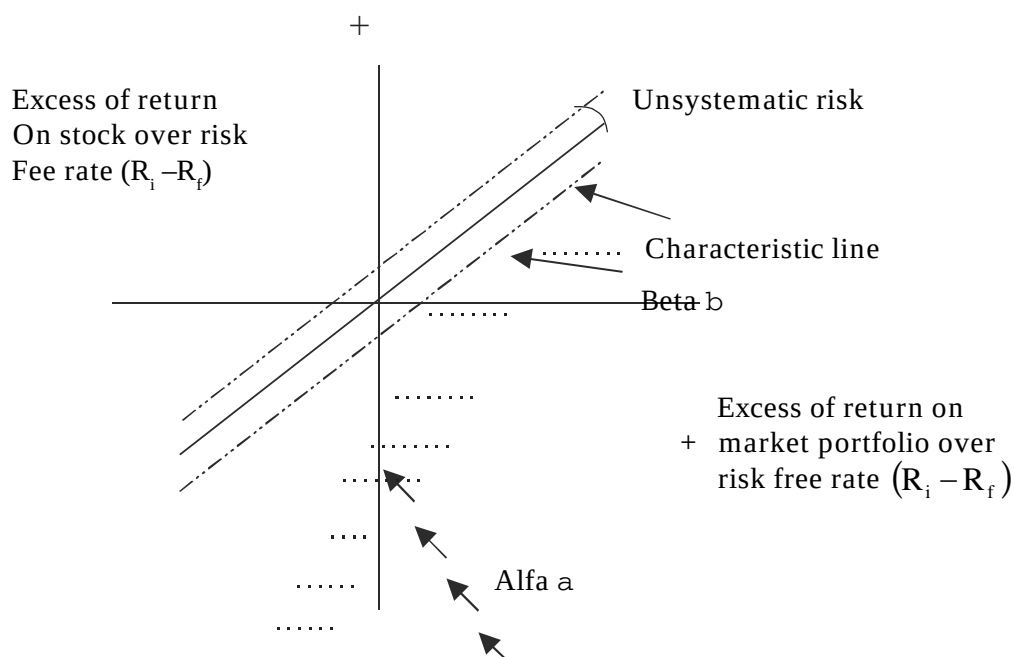
Systematic risks within one market can be managed through a strategy of using both long and short positions within one portfolio, creating a “market neutral” portfolio.

The **Security Characteristic Line (SCL)** represents the relationship between the **market return** (r_m) and the return of a given asset i (r_i) at a given time t . In general, it is reasonable to assume that the SCL is a straight line and can be illustrated as a statistical equation:

$$SCL: r_{it} = \alpha_i + \beta_i r_{mt} + \epsilon_{it}$$

where α_i is called the asset's alpha coefficient and β_i the asset's beta coefficient

A line that best fits the points representing the returns on the assets and the market is called ‘characteristic line’. The slope of the line is the beta of the asset which measures the risk of a security relative to the market. Beta coefficient (β) describes the slope of the characteristic line and so indicates the degree to which the individual security's risk premium reacts to changes in the market portfolio's risk premium. The greater the beta coefficient value the greater the slope of the characteristic line, greater the systematic risk for an individual security. The slope of the characteristic line (regression line) is obtained statistically and it shows the relationship of an individual security with the market.



CHARACTERISTIC LINE

It is observed from the graph that greater the expected return for the market, the greater the expected excess for the stock. The characteristic line equation for the individual security is given below:

$$R_i - R_f = \sigma_i + \beta_i(R_m - R_f)$$

Illustration 7

The rates of return on the security of Company wipro and market portfolio for 10 periods are given below:

Period	Return of Security Wipro (%)	Return on market portfolio (%)
1	20	22
2	22	20
3	25	18
4	21	16
5	18	20
6	-5	8
7	17	-6
8	19	5
9	-7	6
10	20	11

- (i) What is the beta of Security wipro?
(ii) What is the characteristic line for security Wipro?

Solution:

(i)

Period	R_x	R_m	$(R_x - \bar{R}_x)$	$(R_m - \bar{R}_m)$	$(R_x - \bar{R}_x)(R_m - \bar{R}_m)$	$(R_m - \bar{R}_m)^2$
1	20	22	5	10	50	100
2	22	20	7	8	56	64
3	25	18	10	6	60	36
4	21	16	6	4	24	16
5	18	20	3	8	24	64
6	-5	8	-20	-4	80	16
7	17	-6	2	-18	-36	324
8	19	5	4	-7	-28	49
9	-7	6	-22	-6	132	36
10	20	11	5	-1	-5	1
	150	120	120		357	706
	$\sum R_x$	$\sum R_m$			$\sum (R_x - \bar{R}_x)(R_m - \bar{R}_m)$	$\sum (R_m - \bar{R}_m)^2$

$$\bar{R}_x = 15, \bar{R}_m = 12$$

$$\sigma_m^2 = \frac{\sum (R_m - \bar{R}_m)^2}{n - 1} = \frac{706}{9} = 78.44$$

$$\text{Cov} = \frac{\sum (R_x - \bar{R}_x)(R_m - \bar{R}_m)}{n - 1} = \frac{357}{9} = 39.67$$

$$\beta = \frac{\text{Cov}_{xm}}{\sigma_m^2} = \frac{39.67}{78.44} = 0.506$$

(ii) $Y = 15$ $x = 12$

$$Y = a + b x$$

$$15 = a + (0.506 \times 12)$$

$$a = 15 - (0.506 \times 12) = 8.928\%$$

Characteristic Line for Security X = $a + (b \times R_m)$

Where R_m = Expected return on market index



\ Characteristic Line for Security X = $8.928 + 0.506 R_m$

Alpha Coefficient

The alpha coefficient (a) gives the vertical intercept point of the regression line. In a perfect world, the alpha for an individual stock should be zero and the regression line should go through the graph's origin where the horizontal and vertical axis crosses.

If the alpha were positive, the opposite equilibrium process would occur; investors would rush to buy the security which cause the price of the security to rise and the expected rate on it to fall.

Beta Coefficient

The risk of an individual security can be estimated under CAPM model. The market related risk which is also called as 'systematic risk' is unavoidable even by diversification of the portfolio. The systematic risk of an individual security is measured in terms of its sensitivity to market movements which is referred to as security's beta ((3.)). Investors can avoid or eliminate the unsystematic risk by investing funds in wide range of securities and by having well diversified portfolio. Beta coefficient is a measure of the volatility of stock price in relation to movement in stock index of the market, therefore, beta is the index of systematic risk.

$$\beta_1 = \frac{\text{Cov}_{im}}{\text{Var}_m} = \frac{\sigma_i \sigma_m \text{Cor}_{im}}{\sigma_m^2} = \frac{\sigma_i \sigma_m \text{Cor}_{im}}{\sigma_m}$$

Where,

β_1 = Beta of individual security

Cov_{im} = Covariance of returns of individual security with market portfolio

Var_m = Variance of returns of market portfolio (σ_m^2)

Cor_{im} = Correlation coefficient between the returns of individual security and the market portfolio

σ_i = Standard deviation of returns of individual security

σ_m = Standard deviation of returns of market portfolio

A beta coefficient is a relative measure of the sensitivity of an assets' return to changes in the return on the market portfolio. Mathematically, the beta coefficient of a security is the security's covariance with the market portfolio divided by the variance of the market portfolio. The beta factor is the measure of volatility of systematic risk of a security or investment in the portfolio. The beta factor of the market as a whole is 1.0. A beta of 1.0 indicates average level of risk while more or less than that the security's return fluctuates more or less than that of market portfolio. A zero beta means no risk. The degree of volatility is expressed as follows:

- If the beta is one, then it has the same risk profile as the market as a whole, the average risk profile.
- If the beta is less than one, it is not as sensitive to systematic or market risk as the average investment.

- If beta is more than one, it is more sensitive to the market or systematic risk than the average investment.

Beta Factor of a Market Portfolio

If the return from the market portfolio rises or falls, we should expect a corresponding rise or fall in the return from an individual share. The amount of this corresponding rise or fall depends on the beta factor of the share. The beta factor of an investor's portfolio is the total of the weighted average beta factors of each security in the portfolio. As the market portfolio represents all shares on the stock market, it follows that the beta coefficient of the market portfolio must be 1, and all other betas are viewed relative to this value. Thus, if the return from the market portfolio rise by says 2%, the coefficient would be:

$$\frac{\text{Increase in return on Investment}}{\text{Increase in return on market portfolio}} = \frac{2\%}{2\%} = 1$$

CAPM indicates the expected return of a particular security in view of its systematic or market risk. The value of a share price is determined in relation to investment in shares of individual companies, rather than as a portfolio. In practice, for estimation of beta factor the following regression equation is used:

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

Where,

R_i = Rate of return of individual security

a_1 = The intercept that equals the risk free rate (R_f)

b_1 = Beta factor of the individual security

R_m = Market of return

e_i = Random error, which reflects the diversifiable risk of individual security

Illustration 9

WIPRO provides you following information, calculate the expected rate of return of a portfolio:

Expected market return	15%
Risk-free rate of return	9%
Standard deviation of an asset	2.4%
Market Standard deviation	2.0%
Correlation co-efficient of portfolio with market	0.9

Solution:

Calculation Market Sensitivity Index (β_i)

Since, market sensitivity index is not given in the problem, it is calculated by applying the following formula:

CAPITAL MARKET ANALYSIS

$$\beta_i = \frac{\sigma_i}{\sigma_m} = r_{im}$$

Where, β_i = Market sensitivity index or Beta factor

σ_i = Standard deviation of an asset i.e., 0.024

σ_m = Market Standard deviation i.e. 0.02

r_{im} = Correlation coefficient of portfolio with market i.e. 0.90

$$\beta_i = \frac{0.024}{0.02} \times 0.90 = 1.08$$

we can calculate the expected rate of return of a portfolio by applying capital asset pricing model: $E(R_i) = R_f + \beta_i(R_m - R_f)$

Where,

$E(R_i)$ = Expected rate of return of portfolio

R_f = Risk free rate of return i.e., 9%

R_m = Expected return of market portfolio i.e. 15%

β_i = Beta coefficient of investment i.e. 1.08

By substituting, we get

$$E(R_i) = 9 + 1.08(15 - 9) = 9 + 1.08(6) = 15.48 \text{ or } 15.48\%$$

Illustration 10

SCM Portfolio Ltd. has three investments in its portfolio. Its details are given below:

Investment	E(R)	β_i	Proportion of invested funds
Wipro	14%	1.6	50%
SBI	16%	1.2	20%
DCM	12%	0.8	30%

Calculate the weighted average of expected return and Beta factor of the portfolio.

Solution:

Weighted Average of Expected Return of the Total Portfolio:

$$E(R_p) = (14\% \times 0.5) + (16\% \times 0.2) + (12\% \times 0.3) = 7\% + 3.2\% + 3.6\% = 13.8\%$$

Weighted Average Market Sensitivity Index of the Total Portfolio:

$$\beta_p = (1.6 \times 0.5) + (1.2 \times 0.2) + (0.8 \times 0.3) = 0.8 + 0.24 + 0.24 = 1.28$$

Risk-Return Trade off

$$R_m - r_i = \frac{R_m - R_f}{\sigma_m}$$

Where

R_m = Market rate of return

R_f = Risk free return

σ_m = Standard deviation of returns of market portfolio

r_i = Rate of return on individual investment

Illustration 11.

The beta co-efficient of security 'A' is 1.6. The risk free rate of return is 12% and the required rate of return is 18% on the market portfolio. If the dividend expected during the coming year is Rs. 2.50 and the growth rate of dividend and earnings is 8%, at what price should the security 'A' can be sold based on the CAPM.

Solution:

Expected Rate of Return is calculated by applying CAPM formula:

$$\begin{aligned} E(R_i) &= R_f + b_i(R_m - R_f) \\ &= 12\% + 1.6(18\% - 12\%) = 12\% + 9.6\% = 21.6\% \end{aligned}$$

Price of security 'A' is calculated with the use of dividend growth model formula:

$$R_e = \frac{D_1}{P_0} + g$$

Where,

D_1 = Expected dividend during the coming year

R_e = Expected rate of return on security 'A'

g = Growth rate of dividend

P_0 = Price of security 'A'

$$\begin{aligned} R_e &= \frac{D_1}{P_0} + g \\ 0.216 &= \frac{2.50}{P_0} + 0.08 \\ 0.216 &= \frac{2.50}{P_0} + \frac{0.08}{1} \\ 0.216 &= \frac{2.50 + 0.08P_0}{P_0} \\ 0.216 P_0 &= 2.50 + 0.08 P_0 \\ 0.216 P_0 - 0.08 P_0 &= 2.50 \\ 0.136 P_0 &= 2.50 \\ P_0 &= 2.50 / 0.136 = \text{Rs. } 18.38 \end{aligned}$$



Benefits and Limitations of CAPM

Benefits

CAPM model of portfolio management can be effectively used to:

- Investments in risky projects having real assets can be evaluated of its worth in view of expected return.
- CAPM analyses the riskiness of increasing the levels of gearing and its impact on equity shareholders returns.
- CAPM suggests the diversification of portfolio in minimisation of risk.

CAPM is criticised for the following reasons:

- In real world, assumptions of CAPM will not hold good.
- In practice, it is difficult to estimate the risk free return, market rate of return, and risk premium.
- Investors can estimate the required rate of return on a particular investment in company's securities.
- CAPM is a single period model while most projects are often available only as large indivisible projects. It is therefore more difficult to adjust.

Arbitrage Pricing Model

The Arbitrage Pricing Model (APM) looks very similar to the CAPM, but its origins are significantly different. Whereas the CAPM is a single - factor model, the APM is a multi-factor model instead of just a single beta value; there is a whole set of beta values - one for each factor. Arbitrage Pricing Theory, out of which the APM arises, states that the expected return on an investment is dependent upon how that investment reacts to a set of individual macro-economic factors (the degree of reaction being measured by the betas) and the risk premium associated with each of those macro-economic factors. The APM, which was developed by Ross (1976), holds that there are four factors which explain the risk / risk premium relationship of a particular security.

Basically, CAPM says that:

$$E(R_i) = R_f + \beta_i (R_m - R_f)$$

Where, λ is the average risk premium = $R_m - R_f$

$$E(R_i) = R_f + \lambda_1 \beta_{i1} + \lambda_2 \beta_{i2} + \lambda_3 \beta_{i3} + \lambda_4 \beta_{i4}$$

Where,

$\lambda_1, \lambda_2, \lambda_3$, and λ_4 the average risk premium for each of the four factors in the model and $\beta_{i1}, \beta_{i2}, \beta_{i3}$ and β_{i4} are measures of the sensitivity of the particular security 'i' to each of the four factors.

Several factors appear to have been identified as being important (some of which, such as inflation and money supply, industrial production and personal consumption, do have aspects of being inter-related). In particular, researchers have identified:

- Changes in the level of industrial production in the economy
- Changes in the shape of the yield curve

- Changes in the default risk premium (L e., changes in the return required on bonds \ different perceived risks of default)
- Changes in the inflation rate
- Changes in the real interest rate
- Level of personal consumption
- Level of money supply in the economy.

Arbitrage pricing theory (APT), in finance, is a general theory of asset pricing, that has become influential in the pricing of shares.

APT holds that the expected return of a financial asset can be modeled as a linear function of various macro-economic factors or theoretical market indices, where sensitivity to changes in each factor is represented by a factor specific beta coefficient . The model derived rate of return will then be used to price the asset correctly - the asset price should equal the expected end of period price discount at the rate implied by model. If the price diverges, arbitrage would bring it back into line. The theory was initiated by the economist Stephen Rose in 1976.

The APT model

If APT holds, then a risky asset can be described as satisfying the following relation:

$$E(r_j) = r_f + b_{j1} RP_1 + b_{j2} RP_2 + \dots + b_{jn} RP_n$$

$$r_j = E(r_j) + b_{j1}F_1 + b_{j2}F_2 + \dots + b_{jn}F_n + \epsilon_j$$

Where

- $E(r_j)$ is the risky asset's expected return,
- RP_k is the risk premium of the factor,
- r_f is the Risk free
- F_k is the macroeconomic factor,
- b_{jk} is the sensitivity of the asset to factor k , also called factor loading,
- and ϵ_j is the risky asset's idiosyncratic random shock with mean zero.

Arbitrage and the APT

Arbitrage is the practice of taking advantage of a state of imbalance between two (or possibly more) markets and thereby making a risk free profit, Rational Pricing

Arbitrage in expectations

The APT describes the mechanism whereby arbitrage by investors will bring an asset which is mispriced, according to the APT model, back into line with its *expected* price. Note that under true arbitrage, the investor locks-in a *guaranteed* payoff, whereas under APT arbitrage as described below, the investor locks-in a positive *expected* payoff. The APT thus assumes “arbitrage in expectations” - i.e. that arbitrage by investors will bring asset prices back into line with the returns expected by the model portfolio theory.

Arbitrage mechanics

In the APT context, arbitrage consists of trading in two assets – with at least one being mispriced. The arbitrageur sells the asset which is relatively too expensive and uses the proceeds to buy



ne which is relatively too cheap.

Under the APT, an asset is mispriced if its current price diverges from the price predicted by the model. The asset price today should equal the sum of all future cash flows discounted at the APT rate, where the expected return of the asset is a linear function of various factors, and sensitivity to changes in each factor is represented by a factor-specific beta coefficient

A correctly priced asset here may be in fact a *synthetic* asset - a *portfolio* consisting of other correctly priced assets. This portfolio has the same exposure to each of the macroeconomic factors as the mispriced asset. The arbitrageur creates the portfolio by identifying x correctly priced assets (one per factor plus one) and then weighting the assets such that portfolio beta per factor is the same as for the mispriced asset.

When the investor is long the asset and short the portfolio (or vice versa) he has created a position which has a positive expected return (the difference between asset return and portfolio return) and which has a net-zero exposure to any macroeconomic factor and is therefore risk free (other than for firm specific risk). The arbitrageur is thus in a position to make a risk free profit:

Where today's price is too low:

The implication is that at the end of the period the *portfolio* would have appreciated at the rate implied by the APT, whereas the mispriced asset would have appreciated at *more* than this rate. The arbitrageur could therefore:

Today:

- 1 Short sell the *portfolio*
- 2 buy the mispriced-asset with the proceeds.

At the end of the period:

- 1 sell the mispriced asset
- 2 use the proceeds to buy back the *portfolio*
- 3 pocket the difference.

Where today's price is too high:

The implication is that at the end of the period the *portfolio* would have appreciated at the rate implied by the APT, whereas the mispriced asset would have appreciated at *less* than this rate. The arbitrageur could therefore:

Today:

- Short sell the mispriced-asset
- Buy the *portfolio* with the proceeds.
- At the end of the period:
- sell the *portfolio*
- use the proceeds to buy back the mispriced-asset
- pocket the difference.

Relationship with the capital asset pricing model

The APT along with the CAPM is one of two influential theories on asset pricing. The APT



differs from the CAPM in that it is less restrictive in its assumptions. It allows for an explanatory (as opposed to statistical) model of asset returns. It assumes that each investor will hold a unique portfolio with its own particular array of betas, as opposed to the identical “market portfolio”. In some ways, the CAPM can be considered a “special case” of the APT in that the Security market line represents a single-factor model of the asset price, where Beta is exposure to changes in value of the Market.

Additionally, the APT can be seen as a “supply side” model, since its beta coefficients reflect the sensitivity of the underlying asset to economic factors. Thus, factor shocks would cause structural changes in the asset’s expected return, or in the case of stocks, in the firm’s profitability.

On the other side, the CAPM is considered a “demand side” model. Its results, although similar to those in the APT, arise from a maximization problem of each investor’s utility function, and from the resulting market equilibrium (investors are considered to be the “consumers” of the assets).

Using the APT

Identifying the factors

As with the CAPM, the factor-specific Betas are found via a linear regression of historical security returns on the factor in question. Unlike the CAPM, the APT, however, does not itself reveal the identity of its priced factors - the number and nature of these factors is likely to change over time and between economies. As a result, this issue is essentially empirical in nature. Several a priori guidelines as to the characteristics required of potential factors are, however, suggested:

1. their impact on asset prices manifests in their *unexpected* movements
2. they should represent *undiversifiable* influences (these are, clearly, more likely to be macroeconomic rather than firm-specific in nature)
3. timely and accurate information on these variables is required
4. the relationship should be theoretically justifiable on economic grounds

Chen, Roll identified the following macro-economic factors as significant in explaining security returns:

- surprises in inflation;
- surprises in GNP as indicated by an industrial production index;
- surprises in investor confidence due to changes in default premium in corporate bonds;
- surprise shifts in the yield curve.

As a practical matter, indices or spot or futures market prices may be used in place of macro-economic factors, which are reported at low frequency (e.g. monthly) and often with significant estimation errors. Market indices are sometimes derived by means of factor Analysis. More direct “indices” that might be used are:

- short term interest rates;
- the difference in long-term and short term interest rates;
- a diversified stock index such as the S&P 500
- oil prices
- gold or other precious metal prices
- Currency exchange rates

Questions to ponder:



CAPITAL MARKET ANALYSIS

1. Explain the features and assumptions of CAPM model
2. What Relevance Capital assets pricing module has in modern portfolio management
3. Explain Risk-Return Trade off
 1. What are the Benefits and Limitations of CAPM
 2. Differentiate Capital Market Line and Security Market Line.
 3. State the importance of Beta Coefficient.
 4. What is meant by a market portfolio? How would you trade off its risk and return?
 5. What is the significance of Alpha coefficient?
 6. Explain the assumptions of APT model. How is it considered influential in asset pricing?
 7. Define Efficient Frontier
 8. Write in detail the relationship of CAPM with APT Model
 9. What are the advantages of APT over CAPM? Explain in detail.

Objective Questions:

1. The expected return as per CAPM, when $R_m = 22\%$, $R_f = 9\%$, $b = 0.6\%$.
(14.6 % ; 16.8% ; 7.8%)
1. Father of Modern Portfolio theory. _____
(a) John Litner ; b) Harry Markowitz ; c) Jensen)
2. The security market line depicts the expected return for _____
(a single portfolio ; all portfolios and assets ; only the efficient portfolio)
4. According to the APT theory , an investor shall increase returns from his portfolio
(by increasing his funds ; by replacing other assets ; by reducing the risk; without increasing the portfolio funds)
5. The CML represents the relationship between the expected return and _____
(covariance of the portfolio; standard deviation of the portfolio; sensitivity of the portfolio)
6. The APT Model helps to _____
(identify the equilibrium asset price; reduce risk ; eliminate arbitrage)
7. The Security Market Line shows the linear relationship between the expected returns and _____.
(alpha of the portfolio ; Betas of the securities ; variance of the portfolio)
8. In an arbitrage portfolio, the change in the proportions of different securities will add upto _____. (One ; Zero ; Less than One ; Greater than One)

[Answers: Objective questions : 1. ; 2.b ; 3 b ; 4. d ; 5. b ; 6. a ; 7. b ; 8. b]

Problems to solve:

1. The following table gives an analyst's expected return on two stocks for particular market returns.

Market Return	Aggressive Stock	Defensive Stock
8%	5 %	8%
22%	32%	8%



- A. What are the betas of the two stocks?
- B. What is the expected return on each stock if the market return is equally likely to be 8% or 22%?
- C. If the risk-free rate is 9% and the market return is equally likely to be 8% or 22% what is the SML.
- D. What are the alphas of the two stocks?

2. The returns on the equity stock of an Bajaj Electricals Limited and the market portfolio over a 10 year period are given below.

Year	Return on Bajaj Electricals Ltd. (%)	Return on Market Portfolio (%)
1	15	11
2	-6	2
3	18	15
4	32	26
5	14	18
6	25	30
7	2	-3
8	21	25
9	18	15
10	22	20

- (a) Calculate the beta for the stock of Bajaj Electricals Ltd.
- (b) Establish the characteristic line for the stock of Bajaj Electricals Ltd.

3. The expected return for the market is 15 percent, with a standard deviation of 25 percent. The risk free rate is 7 percent. The following information is available for four mutual funds, all assumed to be efficient.

Mutual Fund	Standard Deviation (%)
Prudent	15
Calibre	22
Obroi	26
Sacrun	32

- (a) Calculate the slope of the capital market line.
- (b) Calculate the expected return for each mutual fund.

3. The following table gives an analyst's expected return on two stocks for particular market returns:

Market Return	Aggressive Stock	Defensive Stock
5%	-5%	7%
26%	40%	22%

- (a) What are the betas of the two stocks?
- (b) What is the expected return on each stock if the market return is equally likely to be 5% and 26%?
- (c) If the risk free rate is 8% what is the SML?
- (d) What are the alphas of the two stocks?